

April 2005

DEFENSE LOGISTICS

Actions Needed to Improve the Availability of Critical Items during Current and Future Operations



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Why GAO Did This Study

GAO has identified spare parts supply as a long-standing Department of Defense (DOD) management problem. In December 2003, GAO reported on problems with Operation Iraqi Freedom (OIF) logistics support including shortages of spare parts and supplies in Iraq. This report expands on that effort by assessing (1) what supply shortages were experienced by U.S. forces in Iraq between October 2002 and September 2004 and what impact the shortages had on their operations, (2) what primary deficiencies in the supply system contributed to any identified supply shortages, and (3) what actions DOD has taken to improve the timely availability of supplies for current and future operations.

To address these objectives, GAO judgmentally selected nine items based on lessons learned and after-action reports that represented possible shortages with operational impacts.

What GAO Recommends

This report contains several recommendations to the Secretary of Defense directing that actions, such as ensuring the accuracy of Army war reserve requirements and developing and exercising deployable distribution capabilities, be taken to improve DOD's system for supplying items to U.S. forces. DOD concurred with the intent of the recommendations and cited actions it has taken or will be taking.

www.gao.gov/cgi-bin/getrpt?GAO-05-275.

To view the full product, including the scope and methodology, click on the link above. For more information, contact William Solis at (202) 512-8365 or solisw@gao.gov.

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Actions Needed to Improve the Availability of Critical Items during Current and Future Operations

What GAO Found

U.S. troops experienced shortages of seven of the nine items GAO reviewed. According to the 2004 National Military Strategy, U.S. forces expect to have sufficient quantities of the right items at the right time. However, demand for the seven items exceeded availability sometime between October 2002 and September 2004. The documented impact of these shortages varied between combat units. For example, while units in the 3rd Infantry Division reported that tire shortages reduced their operational capability, forcing them to abandon equipment, the 4th Infantry Division reported no similar effect.

GAO identified five systemic deficiencies that contributed to shortages of the reviewed items, including inaccurate Army war reserve spare parts requirements and ineffective distribution. Annual updates of Army war reserve parts requirements have not been conducted since 1999. As a result, the war reserves did not contain enough track shoes, batteries, and tires to support U.S. forces during initial operations. Effective distribution relies on a seamless process to promptly move supplies from the United States to a customer. GAO found that conflicting doctrinal responsibilities for distribution management, improperly packed shipments, insufficient transportation personnel and equipment, and inadequate information systems prevented the timely availability of four of the items.

Systemic Deficiencies Contributing to Shortages of Seven GAO-Selected Items

Item	Inaccurate Army war reserve requirements	Inaccurate supply forecasts	Insufficient and delayed funding	Delayed acquisition	Ineffective distribution
Batteries	X	X	X	X	
Tires	X	X	X		X
Vehicle track shoes	X	X	X		
Body armor				X	X
Meals Ready-to-Eat			X		X
Up-armored HMMWVs and kits				X	
Vehicle generators ^a					X
Chem-bio suits		No shortage identified			
Rotor blades ^a		No shortage identified			

Source: GAO analysis.

^aThese are Marine-Corps-only items.

While U.S. troops developed short-term solutions to manage item shortages during OIF, DOD and the services have begun to undertake systemic, long-term changes to fix some supply problems identified. While GAO did not evaluate their potential for success, the majority of the changes are focused on distribution, and not on the full gamut of systemic deficiencies GAO identified.

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Abbreviations

AAV	Assault Amphibian Vehicle
AMC	Army Materiel Command
ATLASS	Asset Tracking Logistics and Supply System
CECOM	Communications-Electronics Command
CENTCOM	U.S. Central Command
DLA	Defense Logistics Agency
DOD	Department of Defense
HMMWV	High-Mobility Multi-Purpose Wheeled Vehicle
JSLIST	Joint Service Lightweight Integrated Suit Technology
MRE	Meals Ready-to-Eat
OIF	Operation Iraqi Freedom
SAIC	Science Applications International Corporation
TACOM	Tank-automotive and Armaments Command

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United States Government Accountability Office
Washington, D.C. 20548

April 8, 2005

The Honorable John W. Warner
Chairman
The Honorable Carl Levin
Ranking Member
Committee on Armed Services
United States Senate

The Honorable Duncan Hunter
Chairman
The Honorable Ike Skelton
Ranking Member
Committee on Armed Services
House of Representatives

To support Operation Iraqi Freedom (OIF), the largest deployment of U.S. troops since Operation Desert Shield/Desert Storm in 1990, the Department of Defense (DOD) has undertaken a massive logistics effort,¹ moving more than 2 million short tons of cargo including equipment, spare parts, supplies, and other items several thousand miles to the Persian Gulf. This effort started in late 2001 as U.S. Central Command (CENTCOM)² began planning for OIF, accelerated as troops deployed in the fall of 2002 and major combat operations were launched on March 19, 2003, and continues today while U.S. and coalition forces undertake stabilization efforts in Iraq. From October 2002 through September 2004, DOD reported spending \$51.7 billion for operating support, including fuel, spare parts, and facilities management, and \$10.7 billion for transportation of personnel and supplies to sustain³ U.S. forces before, during, and after major combat operations in

¹ DOD defines "logistics" as the science of planning and carrying out the movement and maintenance of forces. Logistics has six functional areas: supply, maintenance, transportation, civil engineering, health services, and other services. This report will focus on supply and transportation.

² CENTCOM is one of DOD's five geographic combatant commands whose area of responsibility encompasses 27 countries in Southwest Asia, South and Central Asia, and the Horn of Africa.

³ DOD defines sustainment as the provision of personnel, logistic, and other support required to maintain and prolong operations or combat until successful accomplishment or revision of the mission or of the national objective.

Iraq. Despite these expenditures, there have been widespread reports of serious shortages of some critical items needed by U.S. troops.

DOD relies on a number of individual processes and activities, known collectively as supply chain management, to purchase, produce, and deliver products and services to the warfighter during contingency operations consistent with the National Military Strategy. The goal of supply chain management is to deliver the “right items to the right place at the right time” for the warfighter. To meet the initial increase in demand during a contingency, DOD depends on its war reserves—stocks of specifically designated weapon systems, equipment, spare parts,⁴ and other items that are amassed during peacetime. The war reserves are intended to fill the gap until the national supply system can increase production.⁵ DOD relies on defense working capital funds to finance the flow of supplies to the services. These revolving funds are financed by sales revenue rather than direct appropriations. Working capital funds allow the Defense Logistics Agency (DLA) and the services’ logistics agencies to purchase needed items from suppliers. Military units then order items from the logistics agencies and pay for them with appropriated funds when the requested items—either from inventory or manufacturers—are delivered to the units. Supplies are shipped from the United States by air and sea through DOD’s joint distribution system and delivered to deployed units.

Since the 1990s, we have identified DOD’s supply chain management as a high-risk area because of high inventory levels and a supply system that was not responsive to the needs of the warfighter. In a substantial body of work, we have examined a range of problems, including inventory management and shortages of critical spare parts.⁶ DOD also recognizes

⁴ Spare parts are defined as repair parts and components, including kits, assemblies, and subassemblies (both repairable and non-repairable) required for equipment maintenance.

⁵ See *Centralized Inventory Management of the Army Supply System*, Chapter 6, Section I, Paragraph 6-1, c. (3), Army Regulation 710-1 (Apr. 15, 2003) and GAO, *Defense Inventory: Army War Reserve Spare Parts Requirements Are Uncertain*, GAO-01-425 (Washington, D.C.: May 10, 2001).

⁶ See GAO, *Defense Inventory: The Department Needs a Focused Effort to Overcome Critical Spare Parts Shortages*, GAO-03-707 (Washington, D.C.: June 27, 2003) and *Defense Inventory: Analysis of Consumption of Inventory Exceeding Current Operating Requirements Since September 30, 2001*, GAO-04-689 (Washington, D.C.: Aug. 2, 2004).

supply chain management as a serious issue. In the Quadrennial Defense Review for 2001, DOD stated its intention to transform its logistics capabilities to improve the deployment process and implement new logistics support tools that accelerate logistics integration between the services and reduce logistics demand and cost. OIF is one of the first major tests of these new capabilities, and we have reported on the supply chain issues that have impeded support to the warfighter. For example, after visiting the theater in 2003, we provided our preliminary observations on the effectiveness of logistics support during OIF.⁷ Among the problems we observed were the unavailability of spare parts, hundreds of backlogged shipments, and an inability to track shipments at the distribution centers.

Supplying spare parts has been a long-standing DOD management problem. Under the Comptroller General's authority, we evaluated the effectiveness of spare parts and related logistics support being provided to deployed forces for OIF. Our objectives were to assess (1) what supply shortages were experienced by U.S. forces in Iraq and what impact the shortages had on operations, (2) what primary deficiencies in the supply system contributed to any identified supply shortages, and (3) what actions DOD has taken to improve the timely availability of supplies for current and future operations.

We developed detailed case studies of nine supply items that were reported to be in short supply during OIF. (These items, identified in the Results in Brief section, were managed by various organizations within DOD including the Army, the Marine Corps, and DLA.) We chose the items that we believed presented possible shortages with operational impacts based on information available in GAO and military reports, military and contractor lessons-learned studies, and other accounts covering the time period between October 2002 and September 2004. To identify the extent and impact of supply shortages, we visited numerous DOD logistics organizations to obtain data on the production, availability, and distribution of supply items at the national level. When supply data specifically for OIF were not available, we used worldwide data since OIF received supply priority. We also interviewed members of units that had returned from the theater to determine the extent and impacts of item shortages on their operations. We identified deficiencies that affected the availability of

⁷ GAO, *Defense Logistics: Preliminary Observations on the Effectiveness of Logistics Activities During Operation Iraqi Freedom*, GAO-04-305R (Washington, D.C.: Dec. 18, 2003).

two or more of the case study items. We worked with DOD logistics agencies, operational units, and service and geographic commands to evaluate the significance of these deficiencies to DOD's overall logistics system. We also identified DOD's and the services' short-term and long-term efforts to address these shortages. We assessed the reliability of the data we obtained for individual items and determined they were sufficiently reliable for our purposes. We performed our review from March 2004 through February 2005 in accordance with generally accepted government auditing standards. A detailed discussion of our scope and methodology is located in appendix I.

Results in Brief

U.S. troops experienced shortages of seven of the nine items we reviewed. According to the 2004 National Military Strategy, U.S. forces expect to have sufficient quantities of the right items at the right time. During OIF, DOD was responsible for moving millions of tons of supplies and spare parts to theater. However, demand for seven items we reviewed exceeded availability sometime between October 2002 and September 2004. These shortages led, in some cases, to a decline in the operational capability of equipment and increased risk to troops. These items included generators for assault amphibian vehicles, armored vehicle track shoes, Interceptor body armor, lithium batteries, Meals Ready-to-Eat, tires for 5-ton trucks and High-Mobility Multi-Purpose Wheeled Vehicles, and up-armored High-Mobility Multi-Purpose Wheeled Vehicles and add-on armor kits. For example, in August 2003 the Army's inventory contained only 505 tires for 5-ton trucks which fell far below the worldwide monthly demand of 4,828 tires, most of which were needed by troops in Iraq. The remaining two items that we examined—chemical-biological suits and Marine Corps helicopter rotor blades—did not experience shortages in theater. The impact of supply shortages on military operations is difficult to quantify because it varies from one combat unit to another and is not always apparent in DOD's readiness systems. For example, while units in the 3rd Infantry Division reported that tire shortages reduced their operational capability by forcing them to abandon equipment, the 4th Infantry Division reported that its tire shortages had no such effect. Detailed case studies, including the extent of shortages and their impacts, contributing factors, and short- and long-term solutions, for each of the nine items we studied are in appendixes II through X.

Five systemic supply system deficiencies primarily contributed to the shortages for the seven items. As discussed in the body of this report, studies conducted by DOD and defense contractors indicate that

these deficiencies also affected other items in the supply system. The five deficiencies are identified in table 1.

Table 1: Systemic Deficiencies Contributing to Shortages of Seven GAO-Selected Items

Item	Inaccurate and inadequately funded Army war reserve requirements	Inaccurate supply forecasts	Insufficient and delayed funding	Delayed acquisition	Ineffective distribution
Vehicle generators					X
Track shoes	X	X	X		
Body armor				X	X
Batteries	X	X	X	X	
Meals Ready-to-Eat		X			X
Tires	X	X	X		X
Up-armored High-Mobility Multi-Purpose Wheeled Vehicles and kits				X	

Source: GAO analysis.

- **Inaccurate and inadequately funded Army war reserve requirements.** Annual updates of the Army's war reserve requirements have not been conducted since 1999. According to officials from the Army Materiel Command, they had not updated the war reserve requirements because they had not received the latest operational guidance from Army headquarters. However, an Army official provided us with copies of the guidance sent to the Army Materiel Command and attributed the failure to run the model to a variety of reasons, including problems with new databases. This guidance, based on the annually updated defense planning guidance, details the force structure and operations that the Army's war reserve must support. Also, Army data showed that war reserve requirements had not been fully funded for many years. This indicates that the Army has made a risk management decision to not fund war reserves. This decision forced war reserve managers to prioritize the use of available funding, and left some items without a war reserve to support initial operations. The Army's out-of-date and inadequately funded war reserve requirements for spare parts negatively affected the availability of three items we reviewed (armored vehicle track shoes, lithium batteries, and tires). The underfunding problem continues as only \$561.7 million, or 24 percent, of the Army's \$2,327.4 million war reserve requirements were funded as of October 2004. While this funding information has been reported to

Congress, the likely risk to operations of not fully funding the war reserve has not. To improve the accuracy and adequacy of Army war reserve requirements we recommend the Army update the data for its war reserve model based on the latest defense planning guidance, annually update war reserve requirements, and disclose to Congress the impact of risk management decisions to not fully fund the war reserve.

- **Inaccurate supply forecasts.** As indicated by regulation, the Army uses computer models to forecast item demand. The regulation also indicates that the Army's model be able to switch to a wartime forecasting method; however, the model available during pre-OIF planning had no such capability. While DLA had a model to forecast contingencies, it was not effective for all items, such as Meals Ready-to-Eat. Therefore, Army item managers had to manually develop forecasts for OIF, but they did not always have sufficient or timely information on estimated deployment sizes or the duration of operations which are needed to forecast accurate supply requirements. As a result, they underestimated the demand for some items. By contrast, Marine Corps item managers forecasted requirements from operational plans and equipment changes. However, the accuracy of these requirements has not yet been completely reconciled with actual usage during OIF. This is particularly important because, while the Marine Corps may have accurately forecasted requirements and predicted the types of items needed, the Marine Corps has not confirmed the proper quantities. DOD's requirements processes were not able to accurately forecast supply requirements for four items we reviewed (armored vehicle track shoes, lithium batteries, Meals Ready-to-Eat, and tires). To improve the accuracy of the Army's prewar planning for supplies, we recommend the Army develop models that have the capability to accurately forecast operational requirements and ensure that item managers receive timely data from operational plans. To improve the accuracy of the Marine Corps' wartime forecasts, we recommend the service complete its reconciliation of forecasted requirements with actual OIF consumption data and make needed adjustments to its requirements.
- **Insufficient and delayed funding.** By regulation, DOD components are supposed to structure their supply chain processes to provide flexible and prompt support during crises. During OIF, the Army Materiel Command asked for additional funding (known as obligation authority) in order to support the forecasted OIF requirements, but did not receive these funds in a timely manner. While data are not available

to conclusively determine why the process could not provide more timely and adequate funding, the Army's multi-stage requirements validation process may have contributed to the delays. This lack of obligation authority and delays in its release impeded the availability of three items we reviewed (armored vehicle track shoes, lithium batteries, and tires). By contrast, DLA was able to move obligation authority among accounts to support projected demands and did not require numerous validations to justify its forecasted requirements. To improve the sufficiency and timeliness of funding to the Army Materiel Command, we recommend the Army establish an expeditious supply requirements validation process that provides accurate information to support timely and sufficient funding.

- **Delayed acquisition.** Despite requirements that the supply system provide timely support during crises, specific problems delayed DOD's acquisition of three important items we reviewed (Interceptor body armor, lithium batteries, and up-armored High-Mobility Multi-Purpose Wheeled Vehicles). The lack of key materials and long production lead-time continue to affect the production of body armor, and DOD has reported the limitation to Congress. The initial reliance on a single source manufacturer and long production lead-time initially delayed maximum production of lithium batteries. DOD's acquisition decision did not maximize available capacity to produce up-armored High-Mobility Multi-Purpose Wheeled Vehicles and add-on armor kits nor did it give Congress visibility over the basis for its acquisition solution. These acquisition challenges impeded DOD's ability to respond to rapidly increasing demands. To minimize acquisition delays in the future, we recommend the Army and Defense Logistics Agency assess the industrial-base's capacity to meet updated requirements for critical items within the time frames required by operational plans and provide visibility to Congress over acquisition of critical items that emerge during contingencies.
- **Ineffective distribution.** According to DOD guidance, distribution is the operational process of synchronizing all elements of the logistics system to deliver the "right things" to the "right place" at the "right time" to support the combatant commander. We identified several times where the joint distribution system was not synchronized to support the combatant commander during OIF. Among the problems causing this lack of synchronization were (1) conflicting doctrine, or military principles, defining the authority of the geographic combatant commander to synchronize the distribution of supplies from the U.S. to

the theater; (2) improper packaging of air shipments from the U.S., which forced personnel in theater to spend extra time opening and sorting shipments; (3) insufficient transportation equipment and supply personnel in theater; and (4) the inability of logistics information systems to support the requisition and shipment of supplies into and through Iraq. As a result, DOD was not able to distribute sufficient quantities of four items we reviewed (assault amphibian vehicle generators, Interceptor body armor, Meals Ready-to-Eat, and tires). To improve the effectiveness of distribution we recommend that DOD revise current joint distribution doctrine to clarify responsibilities and authorities; develop and exercise, possibly through a mix of simulation and field training, a deployable supply receiving and theater distribution capability that includes trained personnel and necessary equipment; and establish common logistics information systems that support the timely requisition of and visibility over supplies.

Two of the items we reviewed did not have shortages (chemical-biological suits and Marine Corps helicopter rotor blades). While acquisition delays and ineffective distribution resulted in a perceived shortage of chemical-biological suits among personnel deployed to OIF, we could not identify situations where suits were unavailable. Similarly, while rotor blades were identified as a possible shortage, Marine Corps officials and our analysis of supply data indicated there was no actual shortage.

DOD, the services, and the defense agencies have acted to improve supply availability. Many short-term solutions to lessen the impact of supply shortages were instituted during combat operations. For example, as a result of the lithium battery shortage, the Joint Staff developed the “critical few list” to improve the availability of specific items that the services and geographic combatant commands report as critical to their worldwide operations. DOD is also beginning to make systemic, long-term changes to correct some of its supply problems. One of the more notable is the Secretary of Defense’s designation of the U.S. Transportation Command as being responsible for improving distribution. In addition, the Army has identified four areas of logistics focus for the next 2 years: connecting the logistician, modernizing theater distribution, improving force reception, and integrating the supply chain. While we did not evaluate these efforts’ potential for success, we observed that the majority of them focus only on the distribution aspects of logistics problems identified during OIF, not the full gamut of supply deficiencies we identified.

In commenting on a draft of this report, the Department of Defense concurred with the intent of the recommendations and cited actions it has taken or will be taking to eliminate the supply chain deficiencies we noted. While many of the actions cited, if completed, could clearly resolve some problems, others actions did not appear to fully address the need to improve the current practices. In addition, no specific timeline for action was provided; therefore, we modified our recommendations to require specific completion dates. Therefore, we have added a matter for congressional consideration that suggests Congress may wish to require DOD to disclose the risks associated with not fully funding the Army war reserve. The Department's responses are in appendix XI and our evaluation of them appears on page 128 of this report.

Background

CENTCOM, whose area of responsibility encompasses 27 countries in South and Central Asia, the Horn of Africa, the Arabian Peninsula, and Iraq⁸ began planning for OIF in late 2001 (see fig. 1).

⁸ CENTCOM is one of DOD's five geographic combatant commands. The others are: U.S. European Command, U.S. Pacific Command, U.S. Southern Command, and U.S. Northern Command.

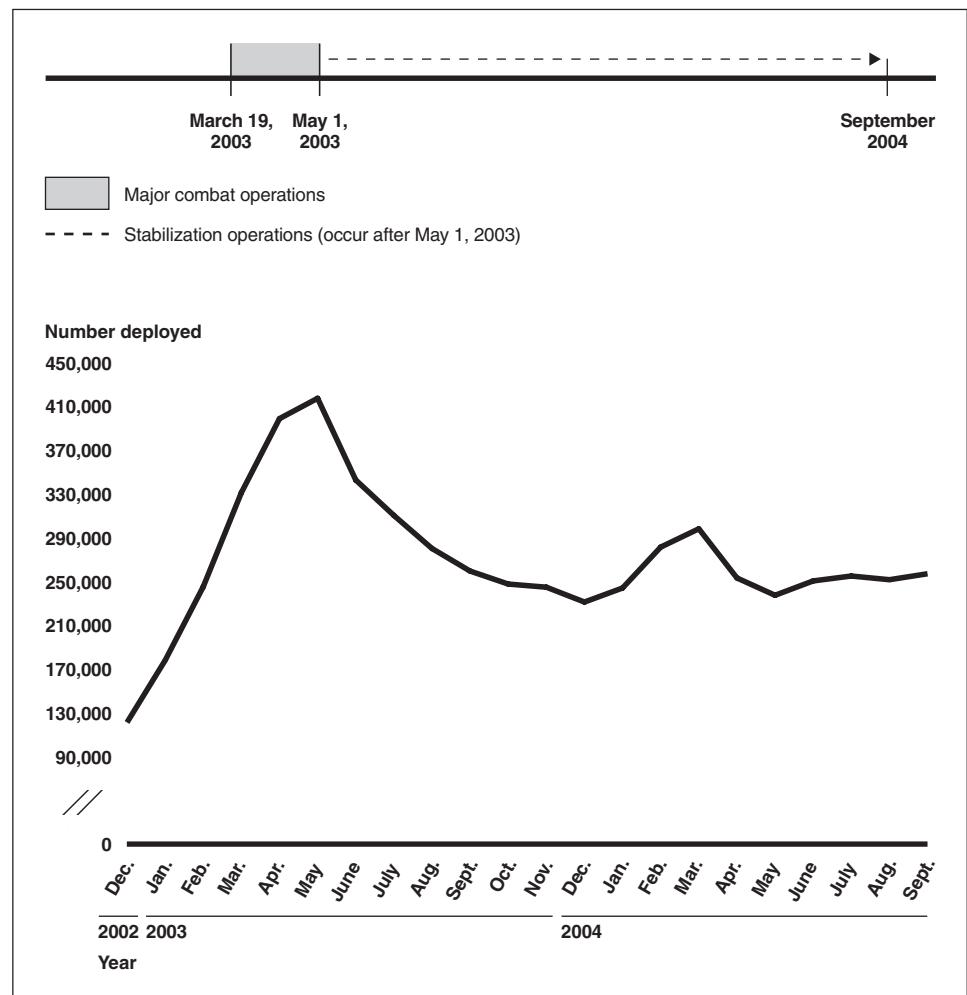
Figure 1: CENTCOM's Area of Responsibility



Source: GAO.

Starting in mid-2002, CENTCOM began to improve the U.S. military's infrastructure in Kuwait. This included an expansion of fuel and port facilities to support the arrival of U.S. military units. Beginning in the fall of 2002, CENTCOM began to deploy troops to the OIF area of operation. These deployments continued up to, and beyond, the start of major combat operations in Iraq on March 19, 2003. According to the Defense Manpower Data Center, the number of military personnel deployed in CENTCOM's area of responsibility in support of OIF and Operation Enduring Freedom steadily increased from over 113,000 in December 2002 to over 409,000 in May 2003 (see fig. 2). During major combat operations, over 280,000 U.S. military personnel were deployed in Iraq, Kuwait, and nearby Persian Gulf nations. All of the services were represented in the theater, but U.S. Army units formed the bulk of military personnel. After major combat operations were officially declared over on May 1, 2003, the total number of personnel in CENTCOM's area of responsibility began to gradually decrease. However, U.S. and coalition forces continue to conduct stabilization operations in Iraq and DOD increased the number of military personnel in Iraq to support the elections in January 2005.

Figure 2: Total Military Personnel Deployed in CENTCOM's Area of Responsibility in Support of Operation Enduring Freedom and Operation Iraqi Freedom, December 2002 through September 2004



Source: Defense Manpower Data Center (data); GAO (timeline).

Organizations Responsible for Logistics

CENTCOM's command authority over units deployed to its area of responsibility allows it to direct all necessary military actions to assigned military forces, including units deployed in both Operation Enduring Freedom in Afghanistan and OIF. Command authority also provides the geographic combatant commander with directive authority over logistics.⁹ The services and other defense components, however, share the responsibility of supplying U.S. forces.¹⁰

The directive authority gives the combatant commander the ability to shift logistics resources within the theater, but logistics support outside of the area of responsibility is usually dependent on the services. The combatant commander relies on the services' logistics components, such as the U.S. Army Materiel Command (AMC), the U.S. Marine Corps Logistics Command, and DLA to purchase supplies and manage inventory. AMC has major subordinate commands that manage supply inventories, such as the Communications-Electronics Command (CECOM) and the Tank-automotive and Armaments Command (TACOM). DLA has a role in packaging supplies for shipment, while the U.S. Transportation Command is responsible for delivering them to theater. The combatant commander assigns one service as the lead for logistics support, including transportation, in the theater.¹¹ During OIF, the Army was the lead service for logistics support.

War Reserves

The military services rely heavily on their specifically designated war reserve stock, including weapon systems, equipment, and spare parts, to equip units when they first arrive in a theater of operation. The Army's war reserves consist of major items including trucks and secondary items such as spare parts, food, clothing, medical supplies, and fuel. Spare parts have the largest dollar value of the Army's secondary items.

War reserves are protected go-to-war assets that are not to be used for purposes such as improving peacetime readiness or filling unit shortages.

⁹ See *Doctrine for Logistic Support of Joint Operations*, Executive Summary, p. vi, Joint Publication 4-0 (Apr. 6, 2000).

¹⁰ See Joint Publication 4-0, Chapter I, p. I-3-4.

¹¹ See *Joint Tactics, Techniques, and Procedures for Joint Theater Distribution*, Chapter II, p. II-7, Joint Publications 4-01.4 (Aug. 22, 2000).

Some of these assets are located in Southwest Asia, the Pacific, Europe, and on special war reserve ships. War reserves are funded through direct congressional appropriations that are requested in the services' annual budget submissions.

AMC is responsible for determining the Army's requirements for war reserve spare parts.¹² To do this, AMC officials use a computer model—the Army War Reserve Automated Process system. The model uses DOD planning guidance and Army information on anticipated force structure including a list of the end items and associated spare parts. For each end item or part, the model uses data on expected usage and spare parts consumption rates based on breakage, geography, environment, and rates of equipment loss due to battle damage.

The Marine Corps Logistics Command and logistics planners from Marine operational units are responsible for determining annually the adequacy of war reserve stock based on current operational plans. Once this is determined, planning officials confirm the availability of the supplies with DLA and other supporting logistics agencies that manage individual items.

Operational Requirements

DOD forecasts operational requirements for spare and repair parts differently than it does for items that result from rapidly emerging needs. DOD forecasting methods for spare and repair parts vary by service. The Army normally uses a computer model to forecast its spare and repair parts requirements based on the average monthly demand over the previous 24 months. The Marine Corps also uses models and involves operational and logistics planners at several levels of command to validate their forecasted requirements.

Operational requirements to support rapidly emerging needs, such as Interceptor body armor and up-armored High-Mobility Multi-Purpose Wheeled Vehicle (HMMWV), are developed outside of normal supply forecasting procedures. They are identified through operational needs statements from the theater that are validated and resourced by the Army. Units in theater submit operational needs statements for the items, which are combined by their higher headquarters into theater requirements.

¹² See Army Regulation 710-1, Chapter 6, Section IV, Paragraph 6-24.

The Coalition Forces Land Component Command¹³ communicates these requirements to the Department of the Army, where they are validated and resourced by offices of the Assistant Secretary of the Army (Financial Management and Comptroller), the Deputy Chief of Staff for Operations, the Deputy Chief of Staff for Program and Analysis, and the Deputy Chief of Staff for Logistics and eventually transmitted to the program manager.

Supply Item Funding

Generally, supplies and equipment for customers—including military units and DOD agencies—are purchased using defense working capital funds or procurement funds.

Defense Working Capital Funds

Of the nine items we examined, seven are purchased using defense working capital funds (assault amphibian vehicle (AAV) generators, armored vehicle track shoes, chemical-biological suits, lithium batteries, Marine Corps helicopter rotor blades, Meals Ready-to-Eat (MRE), and tires). Working capital fund managers at the logistics agencies obligate and spend funds to purchase supplies from manufacturers and repair items to build up inventories in anticipation of sales. Military units then order supplies from the logistics agencies. When the requisitioned supplies are delivered, the units pay for them with funds that are appropriated annually by Congress. The logistics agencies then use this revenue to pay the manufacturers and to cover their own operating costs.

Several funds make up the defense working capital funds, including the Army Working Capital Fund, the Navy Working Capital Fund (which finances Marine Corps managed items), and the Defense-wide Working Capital Fund (which finances Defense Logistics Agency-managed items). AMC uses the Army Working Capital Fund to purchase and maintain supplies.

Procurement Funds

The remaining two items (Interceptor body armor and up-armored HMMWVs) are purchased with procurement funding because they are still in the process of initial issuance. Procurement funds are used to pay for such expenses as the purchase of weapons and weapon components, communication and support equipment, munitions, initial and replenishment spare parts, and modernization equipment.

¹³ During OIF, CENTCOM's army component, Army Central Command, was placed in overall command of all ground forces and renamed Coalition Forces Land Component Command.

Project managers for these items receive congressional appropriations to fund purchases of additional supplies.

Distribution Doctrine and Process

DOD guidance defines distribution as the operational process of synchronizing all elements of the logistics system to deliver the “right things” to the “right place” at the “right time” to support the combatant commander.¹⁴ These elements include physical, financial, information, and communication networks, which can be divided into two general categories—the actual movement of supplies (physical networks) and the use of information technology (financial, information, and communication networks) to support distribution system activities.¹⁵ Table 2 lists the primary DOD regulation and joint doctrine¹⁶ that guide the distribution process.

Table 2: DOD and Joint Guidance on Distribution

Publication number	Title	Date of publication
DOD Regulation 4140.1-R	DOD Supply Chain Materiel Management Regulations	May 23, 2003
Joint Publication 4-0	Doctrine for Logistic Support of Joint Operations	April 6, 2000
Joint Publication 4-01	Joint Doctrine for the Defense Transportation System	March 19, 2003
Joint Publication 4-01.4	Joint Tactics, Techniques, and Procedures for Joint Theater Distribution	August 22, 2000

Source: GAO analysis.

¹⁴ See Joint Publication 4-01.4, Chapter I, p. I-1.

¹⁵ See Joint Publication 4-01.4, Chapter I, p. I-2-3.

¹⁶ DOD defines joint doctrine as the fundamental military principles that guide the employment of forces of two or more services in coordinated action toward a common objective.

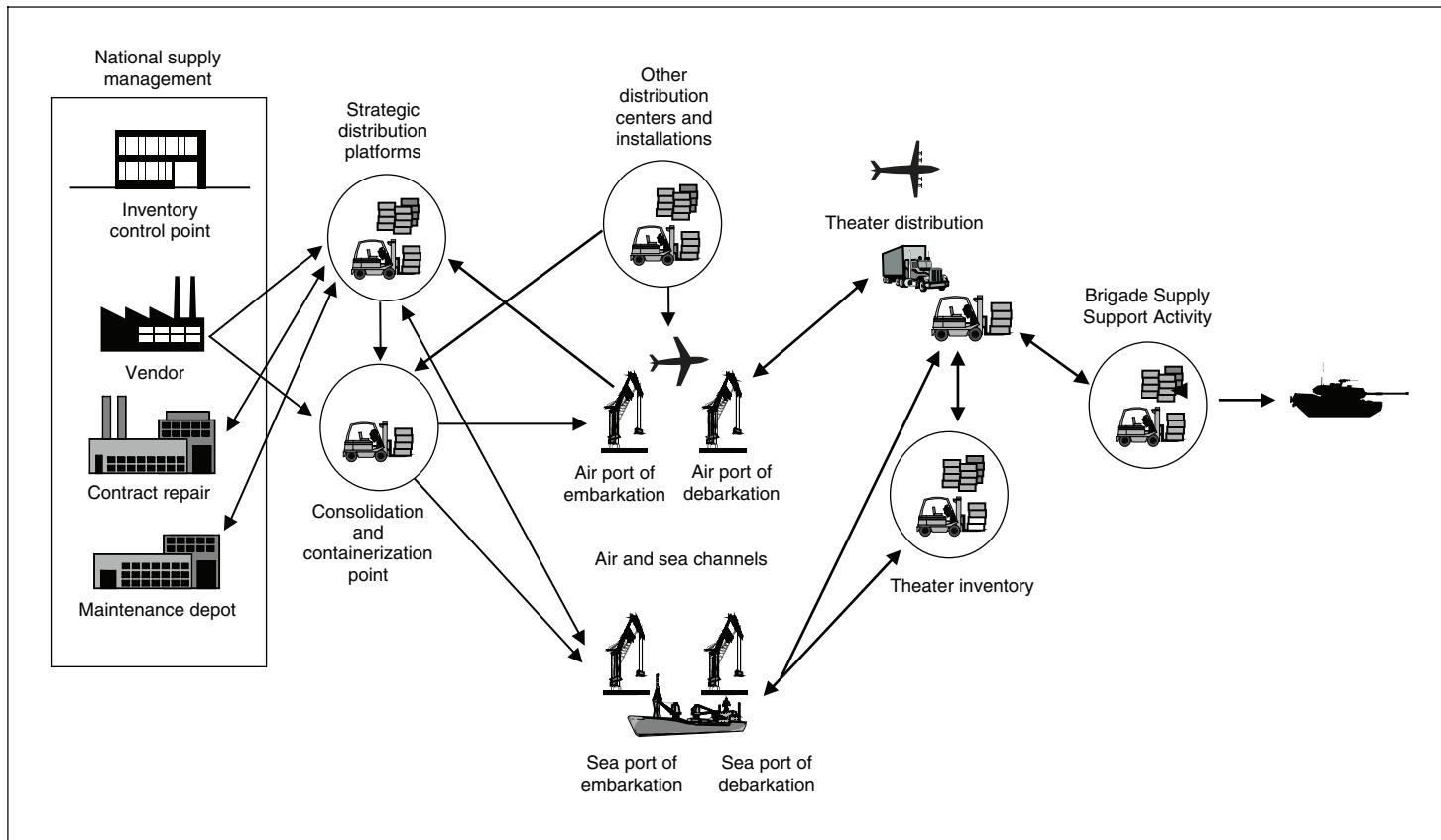
In its guidance, DOD identifies eight fundamental principles of theater distribution:

1. Centralized management: Identify one manager who is responsible for distribution, visibility, and control of items in the theater distribution system.
2. Optimize the distribution system: Give distribution managers the ability to maintain visibility in locations under their control and provide them with resources to meet changing requirements.
3. Velocity over mass: Substitute speed and accuracy for large investments in inventory.
4. Maximize throughput: Reduce the number of times that supplies must be opened and sorted.
5. Reduce customer wait time.
6. Maintain minimum essential stocks: Reduce reliance on large, costly stockpiles.
7. Maintain continuous, seamless, two-way flow of resources: Apply the distribution principles to maintain an integrated and seamless distribution system.
8. Achieve time definite delivery: Deliver the right supplies to the combatant commander at the right place and time.¹⁷

Figure 3 illustrates the complexity of DOD's joint distribution system. The system moves supply items from inventories, vendors, and repair facilities in the U.S. to deployed units in the theater. The system also returns items to the U.S. for repair and maintenance.

¹⁷ See Joint Publication 4-01.4, Chapter I, p. I-7 and I-8.

Figure 3: DOD's Joint Distribution System



Source: RAND.

Recent Studies of OIF Logistics

Several DOD components have recently commissioned assessments of logistics operations during OIF with the aim of identifying areas for improvement. One study, *Objective Assessment of Logistics in Iraq*, commissioned by the Deputy Under Secretary of Defense (Logistics and Materiel Readiness) and the Director for Logistics, Joint Staff, was published in 2004 by the Science Applications International Corporation (SAIC). This study identified problems with DOD's logistics support and contained several recommendations that were endorsed by the Under Secretary of Defense (Acquisition, Technology, and Logistics) such as synchronizing the distribution chain from the U.S. to CENTCOM's area of responsibility and resolving issues with technology.

Another study, commissioned by the Army Deputy Chief of Staff for Logistics, is an independent assessment of the Army's logistics experience in OIF by the RAND Corporation's Arroyo Center. This study focuses on how Army forces were sustained and the performance of the sustainment system during combat operations and initial stability and support operations. RAND's report is currently under review by the Army.

Supply Shortages Reduced Operational Capability and Increased Risk to Troops in Iraq

During OIF, DOD was responsible for moving over 2 million tons of supplies and spare parts to theater. U.S. troops experienced shortages of seven of the nine items GAO selected for review. According to the 2004 National Military Strategy, U.S. forces expect to have sufficient quantities of the right items at the right time. However, demand for the seven items exceeded availability sometime between October 2002 and September 2004. The overall impact of these shortages on military operations is difficult to quantify because it varied between combat units and is not always apparent in DOD's readiness systems. The remaining two items that we examined did not experience shortages in theater. Detailed case studies for the nine items are in appendixes II-X.

Shortages Occurred during OIF for Seven Critical Items

U.S. troops in the OIF theater did not always have sufficient quantities of seven items that we reviewed. For some items, the shortages occurred primarily during initial troop deployments and major combat operations in early 2003; for other items, shortages emerged during the sustainment period after major combat operations were declared over in May 2003. The overall impact is difficult to quantify because it differed between units. For example, while units in the 3rd Infantry Division reported that tire shortages affected their mission by forcing them to abandon equipment, the 4th Infantry Division reported that their tire shortages had no affect on their mission. The following describes the shortages for each of the seven items.

- **Generators for AAVs.** Marine Corps units in Iraq experienced shortages of generators for their AAVs during deployment and combat operations in early 2003. The AAV is a landing vehicle that the Marine Corps used as an armored personnel carrier in Iraq. Without the generator, which provides electric power, the AAV cannot operate. Although 140 generators were reported shipped from the U.S., Marine forces in theater reported receiving only 15. Neither we nor the Marine Corps could find the remaining 125 in the supply system. While the

service did not document any operational impacts specifically due to generator shortages, its forces had to strip parts from about 40 nonoperational vehicles to maintain the operational capabilities of other vehicles.

- **Track shoes for Abrams Tanks and Bradley Fighting Vehicles.** As the conflict in Iraq continued, track shoes, essential components of combat vehicles such as Abrams tanks and Bradley Fighting Vehicles, were not available to meet increasing demands. Although sufficient quantities of track shoes existed to meet demand at the beginning of combat, by May 2003 actual demand was 5 times the forecasted demand primarily because of the heavy wear and tear on track shoes as a result of high mileage, poor road conditions, and extreme desert heat. Major combat units reported that significant shortages of track shoes negatively affected their operational capabilities. For example, the 3rd Infantry Division reported in June 2003 that 111 (60 percent) of its 185 Abrams tanks were unable to perform their missions because of supply shortfalls that included track shoes. Furthermore, 159 (67 percent) of the division's 237 Bradley Fighting Vehicles were not mission capable for the same reason.
- **Interceptor Body Armor.** Demand for Interceptor body armor¹⁸ exceeded supply during OIF. The Coalition Forces Land Component commander decided to increase individual protection by issuing the armor to all troops and civilians. As a result, demand for the body armor surged, with quarterly demand rising from a pre-war level of about 8,600 vests and 9,600 plates, to about 77,000 vests and 109,000 plates by the time the war commenced on March 2003. Back orders for plates peaked at 598,000 in November 2003, while back orders for vests reached 328,000 in December. Even though the services did not report that the lack of body armor impacted their missions during OIF, there were serious concerns. For example, combat support units in the Army and Marine Corps were among the last to be equipped with the armor, increasing the risk to personnel given the enemy's focus on attacking supply routes.

¹⁸ The armor used by U.S. forces during OIF is composed of two primary components: an Outer Tactical Vest and two Small Arms Protective Insert plates, which, when combined, provide protection against both shrapnel and rifle rounds.

- **Lithium batteries.** Army and Marine Corps forces operating in Iraq experienced severe shortages of lithium batteries, particularly BA-5590s and BA-5390s, during major combat operations in the spring of 2003. These nonrechargeable batteries power some 60 critical communications and electronics systems, such as radios and missile guidance systems. Worldwide demand for these batteries surged from a peacetime average of below 20,000 per month prior to September 11, 2001, to a peak rate of over 330,000 in April 2003. As a result, the number of back orders rose rapidly to 900,000 by May 2003. According to Marine Corps officials, if the war had continued at the same pace into May 2003 or beyond, Marine units would have experienced degraded communications capability and increased risk as a result of battery shortages.
- **MREs.** U.S. forces in Iraq experienced shortages of MREs primarily during the deployment and major combat phases in February, March, and April 2003 before normal dining facilities were established. The peak monthly demand for MREs rose to more than 1.8 million cases, while inventories dropped to a level of 500,000 cases. In late April when other food options became available, demand fell rapidly. While certain Army units reported running out of MREs, available data only shows that they came close. According to a RAND study, some Army units came within an estimated 2 days or less of exhausting their on hand quantities.¹⁹ Similarly, according to a Center for Naval Analysis study, at times Marine Corps combat support units had less than 1 day of MREs on hand.²⁰ As a result, both Army and Marine Corps units were at risk of running out of food if supply distribution was hindered.
- **Tires for 5-ton trucks and HMMWVs.** The rising demand for truck tires during and after major combat operations in Iraq nearly exhausted existing inventories. The demand grew as vehicles were driven long distances and were modified with add-on-armor. For example, in August 2003, the Army's inventory contained only 505 tires for 5-ton trucks, which fell far below the worldwide monthly demand of more than 4,800 tires. As a result, back orders spiked to over 7,000 for

¹⁹ See unpublished research report by RAND Arroyo Center on the sustainment of Army units in Operation Iraqi Freedom by Eric Peltz and Marc Robbins.

²⁰ See Center for Naval Analysis, *Marine Corps Operations in OIF: Volume IV—Ground Logistics (Sustainment & Distribution Capacity Management, Classes I & V (W))*, CRM D0008872.A2/Final (Alexandria, Va.: January 2004), 56-59.

5-ton truck tires and to over 13,000 for HMMWV tires. The shortages reduced the operational capabilities of these vehicles and negatively impacted operations in Iraq. For example, 3rd Infantry Division units reported that tire shortages forced them to abandon equipment, and Marine Corps units reported stripping and abandoning otherwise good vehicles because of a lack of tires.

- **Up-armored HMMWVs and add-on-armor kits.** Since the U.S. military began identifying requirements for these vehicles during the summer of 2003, there has been a gap between the number of vehicles required and the number being produced by the industrial base. This new requirement was based on the need to protect soldiers and Marines executing distribution and force protection missions. The up-armored HMMWV provides enhanced protection against rifle rounds and explosive blasts while the add-on-armor kits²¹ provide some additional protection to previously unarmored vehicles. As of September 2004, only 5,330 of the 8,105 required vehicles were in theater. The overall impact of the shortages of up-armored HMMWVs and add-on-armor kits is difficult to measure because units do not report the direct effects of using unarmored HMMWVs. However, according to a Center for Army Lessons Learned study, the risk of harm to both personnel and equipment from improvised explosive devices is greatly reduced when they are transported in an up-armored HMMWV.

Two Items Were Not in Short Supply During OIF

Two items we examined—chemical-biological suits and Marine Corps helicopter parts—did not experience shortages. In these cases, although demands were high because of wartime operations, the defense supply system was able to meet the needs of deployed forces. A discussion of the availability of the two items follows.

- **Chemical-biological suits.** Although there was a perception that sufficient quantities of the new Joint Service Lightweight Integrated Suit Technology (JSLIST) chemical-biological suits were not available during OIF, our work did not identify any actual shortages in the theater of operations. Concerns about a shortage of chemical-biological suits

²¹ These kits, first available in November 2003, consist of armored doors, armor plates below the doors, an armor plate for the protection of the seat backs, and a windshield and windows made of ballistic glass.

arose as a result of an October 2002 Congressional request that DOD provide suits to all military and civilian personnel located in the OIF theater.²² However, according to DLA, the contracting agent for chemical-biological suits, and our analysis,²³ there were sufficient quantities of the suits in the inventory to meet the suit demand during OIF.

- **Marine Corps helicopter rotor blades.** Although concerns were raised about shortages of helicopter parts for Marine Corps helicopters, specifically rotor blades, we did not identify any shortages in the theater of operations. Marine Corps officials reported there were no rotor blade shortages and our analysis of supply data confirms this. In addition, the mission capable rates during OIF for the two helicopters we reviewed—the UH-1N and the CH-53E—were comparable to peacetime rates.

Impact of Shortages Was Not Always Apparent in DOD's Readiness Reporting System

We were not always able to identify the impact of specific shortages because, although DOD's supply system showed shortages of items in theater, DOD's readiness reporting systems did not always show the impact of these shortages on unit operational capability. Such systems as the Global Status of Resources and Training System and Unit Status Reports are intended to identify the ability of units to accomplish their missions and the problems affecting mission performance each month. In addition, other reporting mechanisms, such as lessons learned reports or after-action reports, may also disclose the impact of shortages on operations but do not tie directly to readiness reporting. As a result, we used a variety of documents, some obtained directly from the units, to identify the impact of supply shortages.

For our nine items, the information reported through the various readiness systems, in some cases, was inconsistent with the impact cited in reports. For example, in July 2003, unit status reports from the 4th Infantry Division's battalions showed that approximately 145 to 150 of their 176 Bradley Fighting Vehicles were mission capable, translating to a

²² Letter from Subcommittee on National Security, Veterans Affairs, and International Relations to Secretary of Defense Donald Rumsfeld, October 2, 2002.

²³ GAO, *Chemical and Biological Defense: U.S. Ability to Meet Protective Suit Inventory Requirements Faces Risk*, GAO-04-290 (Washington, D.C.: Apr. 28, 2004).

mission capability rate of around 84 percent. However, a May 2004 lessons learned report prepared by the division indicated that the overall mission capability rate for its Bradleys was 32 percent during the July 2003 time frame and that the degraded status was due to a shortage of armored vehicle track shoes and other vehicle suspension items. In a June 2003 status report, four of the 3rd Infantry Division's five infantry battalions reported that 65 percent of their Bradley vehicles were mission capable. However a 3rd Infantry Division report for June 2003 showed that 65 percent of the division's Bradleys were *non-mission capable* because of supply-related reasons, which unit officials attributed almost exclusively to track shoe shortages.

There were also instances of readiness information about unit status in Iraq not being reported. For example, in August 2003, the 4th Infantry Division's five Armor battalions and one Calvary unit did not enter any mission capability data into the readiness reporting systems about the status of their 247 Abrams tanks. However, the May 2004 briefing report prepared by the division indicated that by July 2003, 28 percent of the division's tanks were non-mission capable. The primary reason given was lack of tank shoes and related suspension parts.

Multiple Supply Chain Deficiencies Contributed to Supply Shortages

Five deficiencies contributed to shortages in the supply of seven of the nine items that we studied. According to DOD data and contractor studies, these deficiencies also affected other items in the supply system. The deficiencies were (1) inaccurate and inadequately funded Army war reserve requirements, (2) inaccurate supply forecasts, (3) insufficient and delayed funding, (4) delayed acquisition, and (5) ineffective distribution. Table 3 identifies the deficiencies that affected each of the seven supply items.

Table 3: Systemic Deficiencies Contributing to Shortages of Seven Supply Items

Item	Inaccurate and inadequately funded Army war reserve requirements	Inaccurate supply forecasts	Insufficient and delayed funding	Delayed acquisition	Ineffective distribution
AAV generators					X
Armored vehicle track shoes	X	X	X		
Interceptor body armor				X	X
Lithium batteries	X	X	X	X	
MREs		X			X
Tires for 5-ton trucks and HMMWVs	X	X	X		X
Up-armored HMMWVs and add-on-armor kits					X

Source: GAO analysis.

Inaccurate and Inadequately Funded Army War Reserve Requirements for Spare Parts Led to Early Shortages during OIF

Army War Reserve Spare Parts Requirements Were Out of Date and Inventory Was Inadequate

The inaccurate requirements for and poor funding of war reserves affected the availability of three of the supply items (armored vehicle track shoes, lithium batteries, and tires). Annual updates of the Army's war reserve requirements for supply items have not been conducted and, as a result, the Army did not have an accurate estimate of the spare parts and other items needed for a contingency such as OIF. In addition, over the past decade, the Army underfunded its war reserve spare parts, which has forced managers to allocate money for certain items and not for others.

Army officials told us that annual updates of its war reserve requirements for spare parts have not been conducted since 1999. AMC uses a computer model, called the Army War Reserve Automated Process, to determine its requirements for spare parts in the war reserve. This model is supposed to be run on the basis of annually updated defense planning guidance and is designed to support the latest war plans and Army force structure.

According to AMC officials, the model has not been run since 1999 because the Department of the Army has not provided the latest guidance, which details the force structure and operations that the Army's war reserve must support. However, an Army official provided us with copies of the Army guidance from 2001, 2003, and 2005 that AMC could have used to initiate computation of war reserve requirements. The Army official stated that

AMC did not run the model for a variety of reasons such as support for ongoing missions and problems with the implementation of a new database and modeling system.²⁴

Because the requirements were out-of-date, the war reserve inventories for some spare parts were inadequate and could not meet initial wartime demands. For example, the war reserve requirement for nonrechargeable lithium batteries (BA-5590s) was not sufficient to support initial operations in OIF. The requirement for BA-5590s was set at 180,000 to support the first 45 days of operations, but this amount was considerably lower than the actual demand of nearly 620,000 batteries recorded during the first 2 months of the conflict. CECOM officials attributed this mismatch to inaccurate battery failure and usage rates in the 1999 model. They also said the model did not include all the communications systems that used nonrechargeable lithium batteries.

In another example, the war reserve requirement for track shoes for armored vehicles was inadequate to keep pace with actual demand during the early months of combat. As table 4 shows, the pre-OIF war reserve requirement for track shoes for Abrams tanks and Bradley Fighting Vehicles was, respectively, 5,230 and 5,626; however, in April 2003 the actual worldwide demand for these tanks was four times higher. The situation was even worse for 5-ton truck tires.

Table 4: War Reserve Requirements, On-Hand Stock, and Items Requested Worldwide

Supply item	War reserve requirement (March 2003)	War reserve on hand (March 2003)	Items requested worldwide (April 2003)
Track shoe (Abrams)	5,230	5,623	23,462
Track shoe (Bradley)	5,626	5,695	20,678
5-ton truck tire	259	16	4,800

Source: TACOM.

²⁴ This new database, called the Logistics Modernization Program, has only been implemented at CECOM.

Since the end of major combat operations, war reserve managers have made manual adjustments to the requirements to reflect supply experiences from OIF. For example, officials told us that they have adjusted the Army and the Marine Corps war reserve requirement for BA-5590 and BA-5390 lithium batteries upward to more than 1.5 million batteries based on the average monthly demand of 250,000 batteries experienced during OIF multiplied by 6 months. Similarly, war reserve managers at TACOM have increased the requirements for Abrams and Bradley tank track shoes to 32,686 and 34,864, respectively. While these actions may correct a particular problem, they do not address the systemic inaccuracy of the Army's war reserve requirements.

In prior reports, we have identified problems with the Army's process for computing the war reserve spare parts requirements. In a 2001 report, we recommended that the Secretary of Defense direct the Secretary of the Army to develop and use the best available consumption factors; improve the methodology used to determine requirements by considering planned battlefield maintenance practices; and develop industrial-base capacity on current, fact-based estimates for the war reserve.²⁵ In a 2002 report, we recommended that the Secretary of Defense direct the Secretary of the Army to have the Commander of AMC change its process of calculating war reserve requirements.²⁶ While the Office of the Secretary of Defense concurred with these recommendations, the Army has yet to implement them.

Risk Management Decisions Led to Years of Low Army War Reserve Funding

The Army's war reserve requirements for spare parts have been significantly underfunded for many years, indicating that the Army has made a risk management decision to not fully fund them. In November 1999, Army documents indicated that the Army had only \$1.3 billion in parts prepositioned, or otherwise set aside for war reserves, to meet its stated requirement of \$3.3 billion. AMC data indicate that a lack of funding for war reserve spare parts continues to be an issue. As table 5 shows, as of October 2004, only about 24 percent (\$561.7 million out of \$2,327.4 million) of AMC's total spare parts requirement is currently funded

²⁵ GAO, *Defense Inventory: Army War Reserve Spare Parts Requirements Are Uncertain*, GAO-01-425 (Washington, D.C.: May 10, 2001).

²⁶ GAO, *Defense Inventory: Improved Industrial Base Assessments for Army War Reserve Spares Could Save Money*, GAO-02-650 (Washington, D.C.: July 12, 2002).

and on hand. Moreover, AMC data show this pattern of underfunding is expected to continue through fiscal year 2009.

Table 5: Status of On-Hand Army War Reserve Spare Parts Requirements as of October 2004

Dollars in millions			
Major subordinate commands	Requirement	Value on hand	Percentage filled
Aviation and Missile Command			
Aviation	\$331.5	\$56.1	16.9
Missiles	98.9	26.8	27.1
Communications-Electronics Command			
	344.2	81.6	23.7
Secondary Item Control Division^a			
	197.0	30.2	15.3
Tank-automotive and Armaments Command			
Armaments	245.4	70.7	28.8
Biological and chemical equipment	117.8	57.0	48.4
Automotive parts	992.5	239.3	24.1
Total	\$2,327.4	\$561.7	

Source: Army Materiel Command.

Note: Totals do not add due to rounding.

^aThe Secondary Item Control Division is responsible for items managed by agencies outside of AMC, such as DLA or the General Services Administration.

As a result of this low funding, war reserve managers told us that they must prioritize how the available funding is allocated based on their professional experience. For example, the war reserve manager for TACOM reported that he tends to spend his available funds on expensive items with long production lead-times, such as tank engines, because they are difficult to acquire on short notice. Conversely, lower cost items with shorter production lead-times, such as tires, do not receive funding priority.

The Army accepts the risk of unfunded war reserve requirements in order to fund other priorities, such as operations and the procurement of new systems. Although, the Army has reported the amount of war reserve underfunding to Congress, the risk of not funding the war reserve is not clearly stated.

Army Supply Forecasts Did Not Accurately Represent Troop Needs in OIF

The Army's requirements process did not accurately forecast the supplies needed to support U.S. forces during OIF for four of the items we studied (armored vehicle track shoes, lithium batteries, MREs, and tires). As indicated by Army regulation,²⁷ AMC normally uses a computer model to forecast its spare and repair parts requirements. The model uses the average monthly demand over the previous 24 months to predict future equipment use and demand. Although the Army regulation²⁸ indicates that the model should be able to switch to a wartime demand forecasting method, AMC officials stated the system has no wartime forecasting capability. As a result, the Army's supply requirements forecasting model could not forecast the wartime surge in requirements during OIF. In contrast, DLA's model has the capability to forecast requirements for contingencies, but it was not completely effective, as in the case of MREs.

Instead of using the model, the Army relied on the expert opinion of item managers, who manage supply items at AMC's subordinate commands. Item managers, however, did not have sufficient information on estimated deployment sizes or duration and intensity of operations to accurately forecast supply requirements for OIF. According to TACOM officials, AMC initially directed item managers to use their expert opinion and knowledge to develop forecasts, without input from operational planners in CENTCOM. AMC officials stated that Army headquarters did not provide them with formal guidance on the duration of the conflict, supply consumption, or size of the deploying force. AMC documents show and their contractors confirm that AMC gathered some anecdotal information on force size and the duration of operations in November 2002. However, item managers at AMC's subordinate commands reported they did not always receive adequate guidance from AMC. For example, officials at TACOM stated they did not receive planning guidance on operational plans from AMC to incorporate into their forecasts of track shoe or tire requirements. The forecasted monthly requirement for Abrams track shoes was 11,125, which was less than half of the actual requirement of 23,462 shoes in April 2003. Forecasts for 5-ton truck tires were also inaccurate. Worldwide demand was forecasted at 1,497 tires during April 2003, less than a third of the actual demand of 4,800.

²⁷ See Army Regulation 710-1, Chapter 4, Section I, Paragraph 4-2.

²⁸ See Army Regulation 710-1, Chapter 4, Section I, Paragraph 4-2, *a.* (4) (b).

In contrast, officials at CECOM reported that in the summer of 2002, operational planners consulted them about the number of nonrechargeable lithium batteries needed to support operations. Subsequently, CECOM officials presented these new requirements to AMC and the Joint Materiel Priorities and Allocation Board and received \$38.2 million in additional obligation authority for BA-5590 and BA-5390 batteries.²⁹ Despite these efforts, demand for batteries outpaced production during OIF combat operations.

The Marines forecast supply requirements for their initial operations based on operational plans³⁰ and modeling factors that involve both operational and logistics planners. Modeling factors include historical supply data, number of personnel involved in an operation, distance of operation, and number of days of operation. Normally, the forecasting process includes many echelons of Marine Corps command. Initially, the 1st Marine Expeditionary Force headquarters provides operational plans to the deploying units that determine the supply requirements for an operation. Once the deploying units forecast a supply requirement, it is returned to headquarters for review. Deploying units review the supply requirements again before passing them to the Marine Forces Pacific Command for final assessment. The Marine Corps Logistics Command, the service's integrated logistics manager, sends the requirements to DLA and other supply providers. Supply providers then inform the Logistics Command and the deploying units about their ability to fill the forecasted requirements. According to the Marines, they used this process to forecast supply requirements before deploying to OIF.

After the end of major combat operations, the Marine Corps began an after-action review process to analyze the effectiveness of their OIF supply forecast. As part of this analysis, the 1st Marine Expeditionary Force assessed the correlation between supply forecasts and supply usage. This analysis showed that 88 percent of the types of repairable supply items forecasted were actually needed,³¹ and 62 percent of the types of

²⁹ The Joint Materiel Priorities and Allocation Board, sets, changes, or recommends policies for allocating supplies in the DOD system.

³⁰ DOD defines operation plans as plans for the conduct of military operations in a hostile environment prepared by the commander of a unified or specified command in response to a requirement established by the Joint Chiefs of Staff.

³¹ A secondary repairable is a spare part that when broken is repaired and returned to inventory rather than replaced.

consumable items forecasted were demanded, in the first 90 days. These data indicate that a significant number of unneeded items could have been sent to theater, placing an unnecessary burden on the distribution system. However, the Marine Corps has not analyzed the accuracy of whether the quantities forecasted equaled the quantities needed. Without such analysis, the Marines cannot determine if their forecasting process provided them with the right items in the right quantity at the right time during OIF.

Insufficient and Delayed Funding Limited the Availability of Supply Items for OIF

AMC Did Not Receive Sufficient Obligation Authority from the Department of the Army to Meet Spare Parts Requirements Promptly

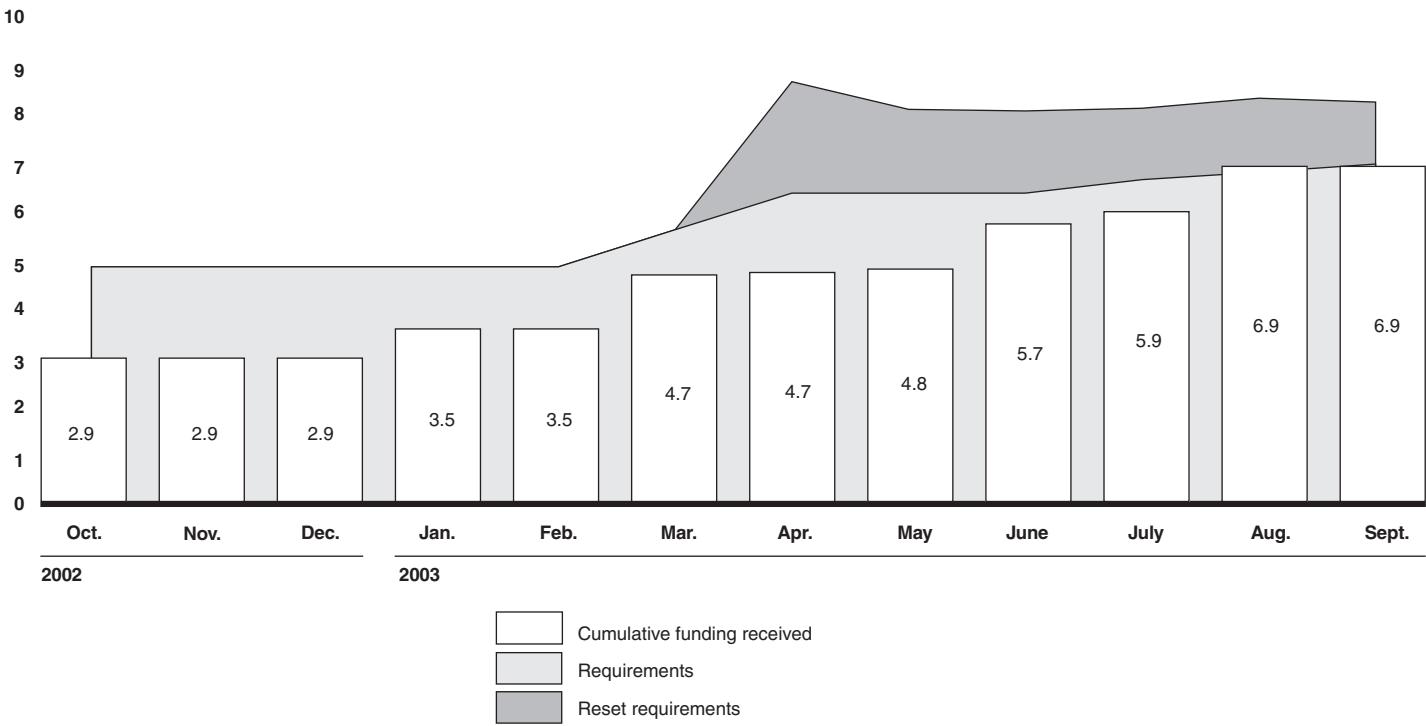
A lack of sufficient funding (obligation authority) within the Army's working capital fund and delays with the release of funds limited the availability of three reviewed items (armored vehicles track shoes, lithium batteries, and tires). The delays may have been due to the Army's multi-stage process to validate requirements. In contrast, DLA's working capital fund was able to move sufficient obligation authority among accounts to support rapidly increasing demands.

According to a DOD regulation,³² DOD components are supposed to structure their supply chain processes and systems to provide flexible and prompt support during crises. However, during fiscal year 2003, AMC did not promptly receive obligation authority to match its stated requirements. The Department of the Army released \$2.9 billion of obligation authority into the Army Working Capital Fund to buy supplies in October 2002 as part of the fiscal year 2003 budget cycle (see fig. 4). This amount was based on the requirements established in the President's Budget prepared 2 years earlier. By the time fiscal year 2003 began, AMC had identified a new supply requirement of \$4.8 billion to support both peacetime operations and the ongoing global war on terrorism, but, the obligation authority provided in October 2002 did not support this revised requirement. While Army headquarters provided some additional funding to AMC, AMC increased its supply requirements again in March 2003 to \$5.6 billion. However, the total obligation authority AMC received at that time equaled only \$4.7 billion. AMC did not receive sufficient obligation authority to support the final validated requirements of nearly \$6.9 billion until the end of fiscal year 2003, 4 months after major combat operations ended.

³² See *DOD Supply Chain Material Management Regulations*, Chapter 1, C1.3.2.1, DOD Regulation 4140.1-R (May 23, 2003).

Figure 4: Fiscal Year 2003 Army Working Capital Fund Supply Management Requirements and Cumulative Obligation Authority Received

Dollars in billions



Source: GAO analysis of AMC and Department of Army data.

Notes:

- (1) Reset is a term used to define bringing a vehicle that was used during Operation Enduring Freedom and OIF back to a fully mission-capable (serviceable) condition. Resetting a vehicle involves extensive use of spare parts.
- (2) Numbers are rounded to the nearest tenth of a billion dollars.

In addition to establishing requirements to support its peacetime and continuing global war on terrorism operations, AMC identified additional requirements, called reset requirements, of \$1.3 billion to support the repair of items coming back from theater. As figure 4 shows, by the end of fiscal year 2003, AMC had received \$6.9 billion of its total requirement of \$8.2 billion (including reset) in obligation authority, a shortfall of \$1.3 billion.

We could not determine exactly why sufficient funding was not provided to AMC more quickly, because sufficient records were not available to track

when AMC and its subordinate commands requested additional funding from Army headquarters or the amounts requested. Similarly, Army headquarters could not provide information about the timing of its requests for additional obligation authority to the Office of the Under Secretary of Defense (Comptroller). However, the Army's requirements validation process likely contributed to delays in the release of obligation authority into AMC's Army Working Capital Fund. After AMC completes its internal validation process and requests additional funding above the programmed requirement during the year of execution, several organizations within Army headquarters reexamine AMC's requirements. In the absence of specific direction in Army regulations, Army headquarters has developed a process for validating AMC's requirements. While the Office of the Deputy Chief of Staff for Logistics has the main responsibility for validating AMC's functional requirements, the Office of Deputy Chief of Staff for Operations, the Office of the Deputy Chief of Staff for Program and Analysis, and the Assistant Secretary of Army (Financial Management and Comptroller) must also review and agree on the requirements. Once these organizations validate the requirements, the Assistant Secretary of the Army (Financial Management and Comptroller) requests obligation authority from the DOD Comptroller. This lengthy process may have delayed the release of funds and contributed to shortages of tires, track shoes, and lithium batteries.

The additional time associated with the Army's validation process was exemplified by events during fiscal year 2003. AMC set its revised supply requirements to \$4.8 billion in October 2002. However, the DOD Comptroller did not release the first additional obligation authority of \$600 million until January 2003, 3 months later. Army headquarters office released its next increase of obligation authority of \$1.1 billion in March 2003, for a total of \$4.6 billion; nearly 6 months after AMC identified the initial requirement. Army officials were unable to tell us when they had submitted their requirements to the DOD Comptroller because they said they often submitted requests for additional obligation authority during the fiscal year informally via e-mails and telephone calls. Accordingly, detailed records were not kept. We were able to confirm that the time between the releases of obligation authority from the DOD Comptroller to the department of the Army did not take longer than two weeks. This indicates that for most of the 6 months, AMC's request for additional obligation authority was somewhere in the Department of Army's validation process.

In addition to delays in receiving funds, AMC suffered from an overall lack of sufficient obligation authority for its major subordinate commands that contributed directly to shortages of tires, track shoes, and lithium batteries

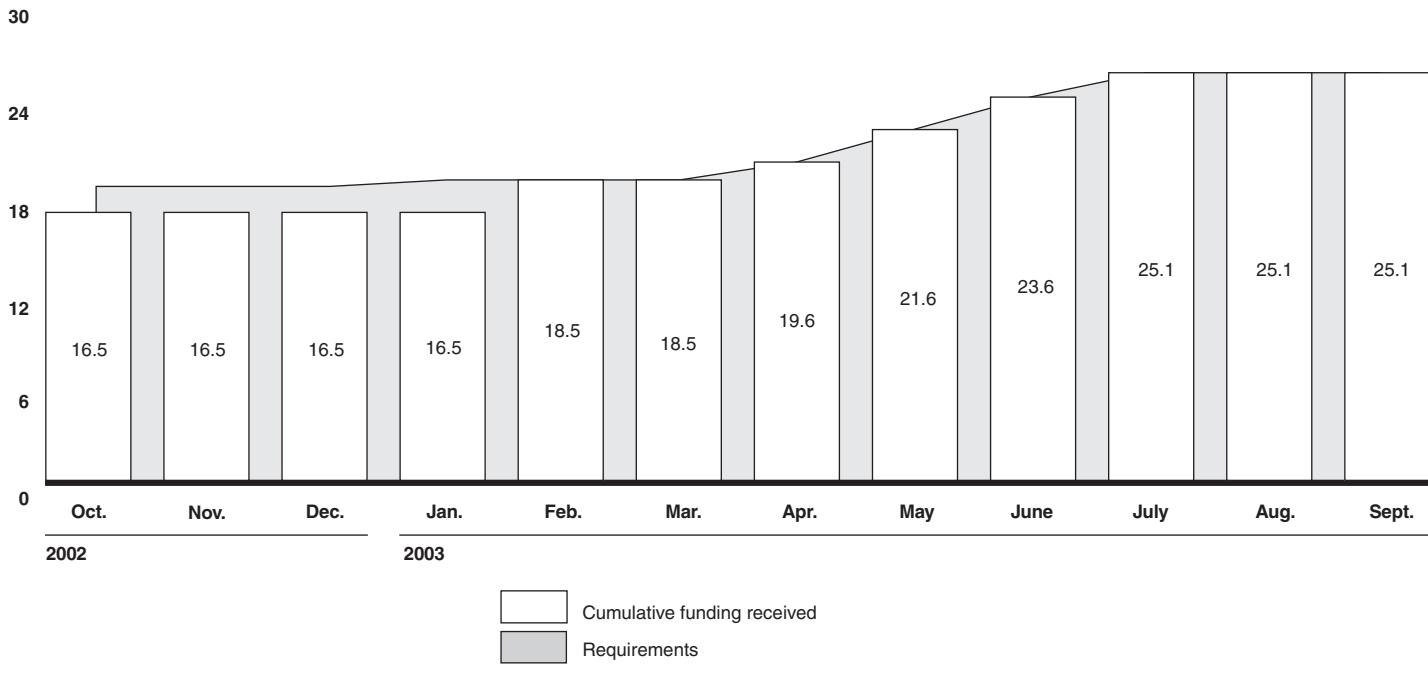
during OIF. Initial priority was to provide funding to the U.S. Army Aviation and Missile Command to support critical aviation systems and then to TACOM for tracked and tactical wheeled vehicles. Without prompt obligation authority, item managers could not contract for supplies in anticipation of customer demands. According to item managers, they need sufficient obligation authority in advance of customer demands in order to have sufficient supplies available. TACOM officials reported that the lack of adequate obligation authority prevented them from buying supplies, including tires and tank track shoes, in anticipation of demands. For example, in October 2002, TACOM item managers identified total requirements of nearly \$1.4 billion, but only had authority to obligate approximately \$900 million. By May 2003, TACOM's requirements had increased to over \$2.1 billion, but only \$1.5 billion in obligation authority was available. By the end of the fiscal year, TACOM's total requirement, including funds necessary to reset the force, totaled \$2.7 billion, but its obligation authority was less than \$2.4 billion. This shows that obligation authority for tires and tank track shoes lagged behind requirements, thereby preventing item managers from buying supplies in anticipation of demand. Similarly, CECOM reported that unfunded requirements over several prior years affected its purchases of lithium batteries. CECOM identified requirements of nearly \$1.5 billion for fiscal year 2003, but received less than \$1.1 billion in obligation authority for the year.

DLA Received Sufficient Obligation Authority to Meet Customer Supply Needs

In contrast to the Army, DLA received sufficient obligation authority from the DOD Comptroller to meet increasing customer supply needs during OIF. DLA set the requirements for its supply management business area at \$18.1 billion and received \$16.5 billion of this amount in obligation authority in October 2002 (see fig. 5). By February 2003, it had received obligation authority that kept pace with increasing requirements. As requirements increased during OIF, the agency was able to request and receive additional obligation authority to purchase supplies in anticipation of customer needs. By the end of the fiscal year, DLA's supply requirements had reached \$25.0 billion, and it had received an equal amount of obligation authority to meet those requirements.

Figure 5: Fiscal Year 2003 DLA Supply Management Requirements and Cumulative Obligation Authority Received

Dollars in billions



Source: DLA.

DLA officials told us they were able to obtain timely increases in obligation authority from the DOD Comptroller because of their requirements validation process. The agency conducts an ongoing review of its requirements throughout the year to ensure they are updated as changes in demand occur. Agency officials then request additional obligation authority directly from the DOD Comptroller. This process allowed DLA to submit requirements and receive increased obligation authority several times during fiscal year 2003. Agency officials stated that having accurate requirements ensures that the DOD Comptroller accepts the requirements without further validation. According to DLA officials, the DOD Comptroller was responsive to the agency's needs, providing additional obligation authority within days of a request.

Delayed Acquisition Caused by a Variety of Challenges

The supply system faced several challenges in rapidly acquiring three of the items we reviewed to meet the emerging demands caused by OIF (Interceptor body armor, lithium batteries, and up-armored HMMWVs and kits). According to a DOD regulation,³³ supply chain processes and systems, which include relationships with commercial manufacturers, should provide flexible and prompt support during crises. The rapid increase in demand for the three items was not anticipated, and as DOD's supply system attempted to purchase them, its efforts were impeded by problems that varied by item. For example, while lithium battery production was limited by the capacity of a sole source supplier and long production lead-times, body armor manufacturers faced shortages of the material components of the armor.

Body Armor Production Did Not Support Increasing Demands

DLA data show that manufacturers of body armor could not meet the surge in demand for the item's two primary components, plates and vests. For example, the worldwide demand for plates increased from 9,586 in December 2002 to 108,808 in March 2003 to a peak of 478,541 in December 2003. A comparison of plate production rates over the same time period shows that only 3,888 plates were produced during December 2002, 31,162 during March 2003, and 49,746 during December 2003.

Increasing requirements exceeded the manufacturer's capacity to produce sufficient body armor. For example, in October 2003, CENTCOM expanded requirements for body armor to include all U.S. personnel in its area of responsibility. The industrial base could not meet this new requirement due to a lack of construction materials and long production lead-times. Vest production was hindered by the limited availability of Kevlar; plate production was initially slowed due to a lack of a special backing for the plates and later by the limited availability of the primary component of the plates, ceramic tiles. In addition, the minimum production lead-time of 3 months limited the manufacturers' ability to accelerate production levels to meet increasing demand, especially for plates, which are more difficult to manufacture than vests. Due to these industrial-base limitations, body armor was not issued to all troops in Iraq until January 2004, 8 months after major combat operations were declared over.

³³ See DOD Regulation 4140.1-R, Chapter 1, C1.3.2.1.

Lithium Battery Production Did Not Support Increasing Demands

Demand for lithium batteries exceeded inventory and production during OIF. As mentioned earlier in this report, the requirement for lithium batteries had not been assessed for the war reserve for several years. Worldwide demand for lithium batteries increased from 38,956 batteries per month in October 2001 to a peak of 330,600 in April 2003. Concurrent battery production was 32,000 in October 2001 and 114,772 in April 2003, and thus was insufficient to meet demand. CECOM expanded battery production from one to three manufacturers and received \$38.2 million to increase production capacity in late 2002; the 8-fold increase in battery demand still outstripped production capacity. A 6-month production lead-time for the batteries precluded the ability of the three manufacturers to meet the peak demand during April 2003. The Marines reported being down to only a 2-day supply of batteries in CENTCOM's area of responsibility in April 2003, despite OIF's priority on worldwide supply shipments. By late 2003, the Army was able to acquire enough batteries so that its inventory exceeded back orders.

Pace of Production of Up-Armored HMMWVs and Kits Did Not Match Maximum Capacity

Meeting rapidly increasing requirements for armoring HMMWVs also met with constraints. For example, CENTCOM stated a requirement for 1,407 up-armored HMMWVs to support OIF in August 2003 that grew to 8,105 vehicles in September 2004. Manufacturers were producing 51 up-armored HMMWVs per month in August 2003. Recognizing the increase in requirements in February 2004, the Army reached an agreement with the manufacturers to increase production to 460 vehicles per month by October 2004. However, the signed agreement with the manufacturer indicated that maximum production could have been increased to 500 vehicles.

Funding was not available when the requirements increased. As a result, Army officials stated that the up-armored HMMWV manufacturers were unable to operate at the maximum capacity. In order to produce vehicles at a consistent and high rate, the manufacturer needs to be assured of consistent funding at least 3 months in advance of delivery. While additional funding was received in fiscal year 2004, program managers stated they often did not know when the next funding release would occur, further complicating their procurement planning. As of September 2004, Army data shows that 5,330 of the 8,105 required up-armored HMMWVs were in CENTCOM's area of responsibility.

Similar issues affected the delivery of add-on-armor kits from the Army's depot system even more dramatically. Kit production in the Army's depot system reached its maximum rate of 3,998 kits per month in April 2004 and

would have met the requirement sooner had the Army not slowed production. Moreover, additional unused capacity was available for kit production. In February 2004, a contractor-operated Army facility informed Army depot managers that it could produce an additional 800 kits per month. While item managers stated they did not use this contractor-operated facility due to issues with contract timing and price, they did not have information about the reason for reducing the level of production at the government-operated facilities. Army data show that kit production will meet CENTCOM's September 2004 requirement for 13,872 kits no later than March 2005.

DOD's Response to Acquisition Challenge Was Inconsistent

DOD's response to the various acquisition challenges presented by these items was inconsistent, lacked transparency, and did not fully exploit all of its capabilities to influence production. If the Army had forecasted an accurate requirement for the batteries, the need for additional manufacturers would have been recognized and production capacity could have been increased on time to better meet the demand. In the case of the other two items, the rapid increase in demand was not as predictable and DOD responded differently to each. DOD officials made a very aggressive effort to focus on and improve the availability of body armor using regulatory authority to increase production. DOD also provided visibility over the problem and courses of action to Congress. By contrast, DOD's response to the need for more armor protection for HMMWVs was more measured and its acquisition solution was less transparent. This may have been why members of Congress have expressed specific concerns about the availability of these items and designated specific funds for them.

Ineffective Theater Distribution Contributed to Shortages of Supply Items

DOD's inability to distribute sufficient quantities of items to troops adversely affected the delivery of many items. While all seven items may have experienced distribution problems, we found that four items (AAV generators, Interceptor body armor, MREs, and tires) were directly and negatively affected, causing troops to experience shortfalls. Distribution is the operational process of synchronizing all elements of the logistics system to deliver the "right things" to the "right place" at the "right time" to support the combatant commander. This complex process involves the

precise integration of doctrine,³⁴ transport equipment, personnel, and information technology. Among the problems encountered during OIF were (1) conflicting doctrine defining the authority of the geographic combatant commander to synchronize the distribution of supplies from the U.S. to theater; (2) improper packaging of air shipments from the U.S., which forced personnel in theater to spend time opening and sorting shipments as they arrived; (3) insufficient transportation equipment and supply personnel in theater; and (4) the inability of logistics information systems to support the requisition and shipment of supplies into and through Iraq.

Conflicting Doctrine Impeded Effective Distribution

We found that conflicting doctrine impeded the establishment of a distribution system capable of delivering supplies to the warfighter smoothly and on time. Distribution begins with the supplier, ends with the warfighter, and includes all systems, both physical and informational, needed to move and manage supplies between the two ends. Currently, joint doctrine institutionalizes separate management of sections of the end-to-end distribution system by placing responsibility for logistics support outside the theater with the individual services and the U.S. Transportation Command.³⁵ However, it also requires the theater commander to synchronize all aspects of logistics necessary to support the mission.³⁶ This conflicting doctrine is contrary to DOD's distribution principle of centralized management, which prescribes that one manager should be responsible for the end-to-end distribution of supplies. A SAIC study also reports that joint doctrine does not contain any specific or prescriptive guidance on how the combatant commander might ensure a seamless distribution process.³⁷

During OIF, the CENTCOM combatant commander could not synchronize the distribution process to support the mission, as required by doctrine, with the level of control that joint doctrine suggests. Instead, the combatant commander had to rely on other DOD components responsible

³⁴ DOD defines doctrine as the fundamental principles by which the military forces or elements thereof guide their actions in support of national objectives. It is authoritative but requires judgment in application.

³⁵ See Chapter I, p. I-4, I-7, I-8, and I-10, Joint Publication 4-0.

³⁶ See Chapter I, p. I-7, Joint Publication 4-0.

³⁷ SAIC, *Objective Assessment of Logistics in Iraq*, Contract No. GS-10F-0091L, Task Order 73510 (March 2004), p78.

for different functions along the distribution process to gain end-to-end visibility as supplies moved through the distribution system. For example, as we reported in December 2003,³⁸ although CENTCOM issued a policy requiring the use of radio frequency identification tags on all shipments,³⁹ to track assets shipped to and within the theater, tags were not always used. Officials from various DOD components reported that, while no data were compiled on the frequency of shipments being labeled with radio frequency identification tags, only about 30 percent of the pallets and containers coming into the theater were tagged. Officials gave various reasons for not following the commander's policy, such as personnel were not trained to use the technology, tags were not available to place on loads moving through the system, and requirements to use the technology were not compatible with current operating systems. In addition, some Army officials reported that CENTCOM does not have jurisdiction over their process for shipping and tracking assets. Therefore, while CENTCOM issued guidance directing the implementation of an in-transit visibility system that relied on the tags, the command could not control the organizations outside of theater responsible for applying the tags to ensure their proper use.

Initial Shipments from the U.S. to the Theater Were Not Properly Packaged

DOD's distribution principle of maximizing throughput calls for reducing the number of times that supplies are opened and sorted in transit so that distribution to warfighters is prompt. Early in OIF, inefficient packaging and palletizing of air shipments created supply backlogs in Kuwait. In turn, these backlogs delayed the delivery of supplies shipped by air to units in Iraq, which included armored vehicle track shoes, body armor, and tires. Insufficient information was available to allow us to link how each individual item was affected by this distribution problem.

According to Army officials, shipments move most efficiently when they are packed and palletized⁴⁰ so that they do not have to be unpacked and reloaded while in transit; sending such "pure" shipments to a single unit is a

³⁸ GAO-04-305R.

³⁹ Radio frequency identification tags are used to track shipping containers and pallets and their contents while in transit. The tags continuously transmit radio signals, which can be read using hand-held or fixed scanners.

⁴⁰ DOD uses a pallet, called the 463L pallet, for air shipments. The pallet is an 88" x 108" aluminum flat base used to facilitate the loading and unloading of aircraft.

standard peacetime procedure. During OIF, Army officials expected each pallet or container to contain supplies for only one unit or location. However, initial shipments included spare parts and supplies for several geographically separate units. DLA officials stated that U.S. distribution centers could not handle the high volume of supplies and many shipments were loaded with items for more than one customer or “mixed.” They also said that the volume of supplies arriving daily for consolidation into air shipments overwhelmed distribution centers in the U.S. The facilities were structured to handle peacetime requirements and lacked the necessary equipment and personnel to handle the surge capacity associated with wartime. Officials stated that mixed cargo was often sent to the theater without being sorted in order to make room for incoming supplies. Moreover, the lack of sorting continued because of a miscommunication between CENTCOM and DLA, the shipper. CENTCOM expected the peacetime practice of pure pallets would continue during OIF, while DLA officials focused on moving pallets to theater regardless of whether they were pure or mixed. However, at that same time RAND analysts reported that DLA facilities were sending pure pallets to U.S. Army units in Europe and Korea.

Once in theater, mixed shipments had to be manually opened, sorted, and re-palletized at theater distribution points, causing additional delays. According to staff at the Theater Distribution Center in Kuwait, some mixed shipments were not marked with all the intended destinations so the contents of the shipments had to be examined. Army officials stated that because mixed pallets of supplies were initially sent to theater, over 9,000 pallets piled up at the center. By the fall of 2003, 30 percent of the pallets arriving at the center still had to be reconfigured in some way. The Army and DLA recognized the problem and worked in conjunction with CENTCOM to establish a “pure palleting” process at the distribution center in Pennsylvania. This resulted in potentially longer processing times in the United States in order reduce customer wait time in theater.

According to a RAND study,⁴¹ the pallets arriving in theater between January and August 2003 contained more than 20,000 cardboard boxes of small items. Over 4,300 boxes, about one in every five, were mixed and may have been opened and the contents sorted before being forwarded on to

⁴¹ See unpublished research report by RAND Arroyo Center on the sustainment of Army units in Operation Iraqi Freedom by Eric Peltz and Marc Robbins.

customers, which further delayed delivery. The RAND study showed that it took an average of 25 to 30 days for such mixed boxes to travel from a port in theater, through the theater center, to the supply activity that ordered it. In contrast, when a box with items for only one unit was shipped, it took an average of 5 to 10 days to reach the customer.

Shortages of Supply Personnel and Transportation Equipment Hampered Supply Distribution

The lack of sufficient logistics resources, such as trained supply personnel and cargo trucks, hindered DOD's efforts to move supplies promptly from ports and theater distribution centers to the units that had ordered them, as expected under the DOD principle of optimizing the distribution system. As a result, some troops experienced delays in receiving MREs and other supplies, thereby reducing operational capabilities and increasing risk.

According to military personnel, there was a shortage of support personnel in theater prior to and during the arrival of combat forces. Moreover, those that arrived were often untrained or not skilled in the duties they were asked to perform. The effects of these shortages of trained personnel were most evident at the Theater Distribution Center and resulted in delays in the processing (receipt, sorting, and forwarding) of supplies, and backlogs. For example, in the late February to early March 2003 time frame, the Center had only about 200 reserve personnel and did not reach its authorized staffing level of 965 supply/support personnel until May 2003. Moreover, when the center opened, it already had an estimated 5,000-pallet backlog and its commander employed ad hoc work details drawn from surrounding support units to help. Furthermore, organizations outside of the theater, such as TACOM, sent personnel to Kuwait to ensure that specific items, such as tires, were properly processed and sent to the correct customers.

Moreover, according to after-action reports, lessons learned studies, and discussions with military personnel, the lack of adequate ground transportation, especially cargo trucks, contributed significantly to the distribution problems. For example, an Army official with the 377th Theater Support Command, which was responsible for logistics support in Kuwait, stated that when combat began his unit needed 930 light/medium and medium trucks but had only 515 trucks on hand. Although his unit "managed" with what was available, he said that the shortage of equipment used to haul supplies into Iraq created a strain on materiel movement. Both the Marine Corps and the 3rd Infantry Division also reported that available transportation assets could not meet their capacity requirements. Even high-priority items, such as food did not always move as intended. According to a CENTCOM after-action report,

contractors responsible for moving MREs from ports to the Theater Distribution Center at times had only 50 of the 80 trucks needed. DLA officials reported that at one time 1.4 million MREs were stored at a port in theater, awaiting transport to customers.

One cause for the distribution resource problems was the failure of the force deployment planning process to properly synchronize the flow of combat and support forces. DOD normally uses time-phased force deployment data to identify and synchronize the flow of forces during an operation. Key elements of this process include requirements for military transportation companies, contractor provided services, and host nation logistics support. However, the process was “thrown out” in the planning leading up to OIF. Around November 2002, DOD started to use another method for deployment planning, referred to as the Request for Forces process.

The Request for Forces process segregated the initial deployment plan into over 50 separate deployment orders. DOD’s priority was for combat forces to move into theater first. Under this new process, logistics unit commanders had to justify the flow of their units and equipment into the theater—often with little success. According to some DOD planners, this approach did not adequately meet planner needs, especially the needs of logisticians. Each deployment order required its own transportation feasibility analysis, which resulted in a choppy flow of forces into the theater. This in turn caused imbalances in the types of personnel needed in the theater to handle logistics requirements. Furthermore, a RAND study suggests that distribution assets, particularly for components such as the 377th Theater Support Command and the 3rd Corps Support Command, were either deleted from the deployment plan or shifted back in the deployment timeline.⁴² As a result, logistics personnel could not effectively support the increasing numbers of combat troops moving into theater.

DOD took steps to mitigate the impact of some distribution problems, but these did not always work. For example, according to a RAND report, priority was given to moving critical supplies, such as food, water, ammunition, and fuel. Other items, to include spare parts, were moved on a very limited, opportune basis. As a result, according to one after-action report, it took nearly 2 weeks after U.S. forces moved into Iraq for the first

⁴² See unpublished research report by RAND Arroyo Center on the sustainment of Army units in Operation Iraqi Freedom by Eric Peltz and Marc Robbins.

shipment of spare parts to reach combat forces, and this delivery was inadequate to support an entire division engaged in combat operations. Moreover, the Army confirmed that after 45 days of enemy engagement, moving water still consumed over 60 percent of available theater transportation trucks. A Marine Corps after-action report⁴³ listed repair parts distribution as a “near-complete failure.”

In order to move supplies to the troops, both the Army and Marines contracted for additional trucks. For example, the Marine Corps contracted for \$25.6 million in services from several commercial trucking companies to support combat operations. It justified this action by identifying deficiencies in the provision of transportation support they expected from other components in theater. However, Army officials stated that its contractors did not always have sufficient trucks to move supplies as required because contracts did not specify a level of operational readiness for trucks. As a result, even if trucks were available, they were not always functional. In its after-action report, the 3rd Infantry Division stated that available transportation assets and contracted host nation support could not meet divisional requirements for carrying capacity.

Information Systems did not Support Supply Distribution

According to military doctrine, financial, communication, and information systems used to support supply distribution must be accessible, integrated, connected, and contain accurate and up-to-date information.⁴⁴ In other words, these systems need to provide a seamless flow of all types of essential data from the point of production to the warfighter. However during OIF, the logistics systems used to order, track, and account for supplies were not well integrated; moreover, they could not provide the essential information necessary to effectively manage theater distribution.

Data Transmission Problems Hindered Supply Requisitions

Logistics information systems in use during OIF could not effectively transmit data, making it difficult to process and track requisitions for critical supplies. A number of factors limited communications between the

⁴³ U.S. Marine Corps Enduring Freedom Combat Assessment Team, Operation Iraqi Freedom, Implications for Seabasing, October 22, 2003.

⁴⁴ See Joint Publication 4-0, Chapter I, p. I-17 through I-19 and Joint Publication 4-01.4, Chapter I, I-8 and I-9.

various logistics systems, including a lack of bandwidth in the theater to satisfy all systems users, systems that were incompatible with each other, units lacking the necessary equipment or being delayed in connecting to the supply system, and distances being too great for supply activities to effectively transmit data by radio. For example, the supply activities in the Army's 3rd Infantry Division only received about 2,500 of the over 10,000 items—including armored vehicle track shoes, lithium batteries, and tires—they requisitioned between August 2002 and September 2003. Officials at the 3rd Infantry Division attributed this issue specifically to communications problems between systems. Army officials also attribute poor communications as a major factor leading to a \$1.2 billion discrepancy between the amount of supplies shipped to the theater and the amount actually acknowledged as received, which we reported on in December 2003.⁴⁵

The Marine Corps similarly experienced communications problems between its information technology systems during OIF. Marine forces deployed with two different versions of the Marine Corps Asset Tracking Logistics & Supply System logistics information system, which were not compatible with each other. Marine Corps units in the 1st Marine Expeditionary Force were using the Asset Tracking Logistics & Supply System I for frontline logistics, while the 2nd Marine Expeditionary Force was using the Asset Tracking Logistics & Supply System II+ for theater support.⁴⁶ Therefore, requisitions from Marine support activities at the front lines could not be transmitted directly to Marine logistics units in the rear. Instead, the Marines used other processes, such as e-mail and satellite phone to requisition supplies. However, this left ordering units without any information on the status of their requisitions. As a result, many duplicate orders were submitted and may have unnecessarily added more cargo to the already overwhelmed theater distribution system. A study by SAIC also noted that the lack of logistics communications was a weakness during OIF.⁴⁷ The Army's Deputy Chief of Staff for Logistics has since provided

⁴⁵ GAO-04-305R.

⁴⁶ Generally, the 1st Marine Expeditionary Force served as the combat force during the operation, while the 2nd Marine Expeditionary Force provided theater-level supply support.

⁴⁷ See SAIC, *Objective Assessment of Logistics in Iraq*, Contract No. GS-10F-0091L, Task Order 73510 (March 2004) Chapter 5.

satellite communications equipment to the units operating in theater to help alleviate these communication difficulties.

Available Logistics Information Systems Did Not Provide Adequate Visibility

Another major problem encountered during OIF was a lack of adequate visibility over supplies in the distribution system. While the operation order for OIF called for the use of radio frequency identification, tracking was limited primarily by a failure to place radio frequency identification tags on all shipments sent to the theater and a lack of fixed scanners needed to read radio frequency identification tags. For example, some ports, such as one we observed in Bahrain, had no scanners at all.

Another equally challenging problem was that scanners often failed under the harsh environmental conditions. According to one Army assessment, only 50 percent of the scanners inspected in Kuwait were operational. In addition to problems with the radio frequency identification technology, there was no suitable information system infrastructure to track and identify supply assets. SAIC reported that the Joint Total Asset Visibility system could not provide commanders with the asset visibility they needed, while military officials in theater told us they knew of no joint system that tracked supplies from the point of production to the warfighter. Rather, logistics personnel relied on a number of unintegrated tracking systems. As a result, CENTCOM and the major combat forces in the Army and Marine Corps could not adequately track or identify supplies moving to and within the theater.

The lack of in-transit visibility over supplies significantly effected distribution. For example, an Army official responsible for logistics operations at the Theater Distribution Center noted that incomplete radio frequency identification tags forced the center's personnel to spend time opening and sorting incoming shipments. This, in turn, significantly increased processing time, contrary to DOD's principle of maximizing throughput. As a result, according to a CENTCOM issue paper, around 1500 Small Arms Protective Inserts plates for body armor were lost. Another CENTCOM report stated that 17 containers of MREs were left at a supply base in Iraq for over a week because no one at the base knew they were there. According to Marine Corps officials, they became frustrated with their inability to "see" supplies moving towards them and lost trust and confidence in the logistics system and processes. For example, the

Marines could only verify the receipt of 15 out of 140 AAV generators that were shipped to them.

Changes to Unit Address Codes Disrupted Logistics Information Systems

The use of new OIF-specific address codes, known as Department of Defense Activity Address Codes, for ordering supplies limited the effectiveness of logistics information technology.⁴⁸ The codes ensure that supplies are sent to the correct address of the ordering unit and that the correct unit is charged for the supplies. Because of poor linkages between Army logistics and financial systems, a problem of where to ship and who to bill surfaces unless a unit or activity deploys intact. For example, while some parts of the 3rd Infantry Division remained in the U.S. during OIF, the majority of the division deployed to Iraq. To ensure that ordered supplies went to the correct location of a deployed unit and that the unit was correctly charged, new codes specifically set up for OIF were issued to deploying entities. Meanwhile, the original codes remained with that portion of the unit that did not deploy. Approximately 10,000 new codes were created for OIF. This caused significant disruptions to logistics information systems as new data had to be manually updated in each system. Many problems occurred during this process, such as the issuance of inactive codes, use of codes already assigned to other units, and incorrect data being input into logistics systems. These problems were another factor contributing to the \$1.2 billion discrepancy between supplies shipped and supplies received.

Furthermore, there was a delay in updating the master code schedule that contained all the locations associated with the new codes. This caused significant problems for the Theater Distribution Center. According to an April 10, 2003 Theater Distribution Center log entry, “Upwards of 50% of pallets shipped to Doha and 20-30% of pallets shipped to Arifjan are being returned/rejected with the reason being, ‘it doesn’t belong here.’ The master [codes] are not being updated when units move in or out and the [theater distribution center] is double and triple handling cargo.” Given that the center was already experiencing problems with personnel and

⁴⁸ A Department of Defense Activity Address Code is a six-position numeric code that uniquely identifies a unit, activity, or organization that has the authority to requisition and/or receive materiel.

equipment shortages; additional handling of the same supplies increased their difficulties.

Logistics Personnel Were Not Trained on Some of the Logistics Information Systems in Use

A lack of adequate training for logistics personnel also negatively impacted the performance of logistics information systems. For example, according to a 101st Airborne after-action review, loading codes and interfacing with data caused problems that training could have resolved. Lack of training also contributed to problems with asset visibility. According to a logistics study, units were generally not trained in the use of radio frequency identification devices. Marine Corps officials likewise stated that their personnel were untrained in the use of tracking equipment.

DOD Actions to Improve Supply Availability for Current and Future Operations

As a result of logistics issues that arose during OIF, DOD, the services, and the defense agencies have undertaken a number of actions to improve the availability of equipment and supplies during ongoing and future operations. Some are short-term actions aimed at improving immediate supply availability. For example, as a result of the battery shortage, the Joint Staff Logistics Directorate established in July 2003 a revolving “critical few list” of approximately 25 items that the services and various commands report as most critically needed worldwide. The Joint Staff Logistics Directorate, in conjunction with the services, determines the causes of the shortages and makes recommendations to the Office of the Secretary of Defense and the services for corrective action and execution. Other actions are long-term, systemic changes that are designed to improve the overall effectiveness of the supply system. While we did not evaluate the changes’ potential for success, we observed that the majority of them focus on the distribution aspects of logistics problems, not the full range of supply deficiencies we identified. However, other GAO engagements are currently underway to assess some of these initiatives. (Specific short-term and long-term actions related to each item are noted in the appendixes.)

- **Inaccurate and inadequately funded war reserve requirements.** The Army has not updated or run its war reserve model in order to systemically ensure the accuracy of its war reserve requirements. Due to its risk management decisions, it has also not funded its war reserve requirements. However, the Army has made manual changes to its war reserve inventory levels, based on the usage of certain items during OIF.

- **Inaccurate supply forecasts.** DOD and the services have not undertaken systemic actions specifically aimed at improving the accuracy of supply forecast. However, DLA has undertaken action to improve its customer support through its Customer Relationship Management program, which could potentially improve its ability to forecast customer demands.
- **Insufficient and delayed funding.** The Army has not undertaken long-term actions to expedite its funding process during contingencies to be more responsive to customer needs. However, it has undertaken short-term actions to obtain additional funding for specific supply items. For example, AMC directed funding towards armored vehicle track shoes.
- **Delayed acquisition.** DOD has not undertaken long-term actions to address acquisition issues that contributed to shortages of certain case study items. However, DLA has undertaken other actions to improve its ability to leverage industrial-base capabilities. DLA seeks to improve industrial-base support through its collaborative planning initiatives with industry. For example, its Strategic Materiel Sourcing program establishes long-term contracts for approximately 500,000 (of a total 4.6 million) items the agency considers critical to its customers' needs. In addition, its Strategic Supplier Alliances program establishes formal relationships with the agency's top 32 sole source suppliers.
- **Ineffective distribution.** DOD has undertaken many initiatives to improve its distribution system, including the Secretary of Defense's designation of the U.S. Transportation Command as the Distribution Process Owner. According to a Secretary of Defense memorandum,⁴⁹ the U.S. Transportation Command is responsible for improving the overall efficiency and interoperability of distribution-related activities. In January 2004, the command established a CENTCOM Deployment and Distribution Operations Center, which is responsible for directing airport, seaport, and land transportation operations within the OIF theater. DOD's Pure Pallet initiative seeks to reduce inefficiencies in the distribution process and improve in-transit tracking of shipments by building containers and pallets with radio frequency identification tags that are designated to units within a specific geographic location.

⁴⁹ Secretary of Defense, "Actions to Improve Logistics and Global Supply Chain Management," Memorandum (Washington D.C.: Sept. 16, 2003).

The Army and DLA have also undertaken numerous actions to improve the distribution system. The Army has identified four areas of focus for the next 2 years: (1) “Connect Army Logisticians” by using technology to provide logisticians and warfighters with real-time visibility over distribution and warfighter requirements, (2) “Modernize Theater Distribution” by developing a distribution-based logistics system to support the warfighter, (3) “Integrate the Supply Chain” by providing a system wide view of the supply chain through the integration of processes, information, and responsibilities, and (4) “Improve Force Reception” by enhancing the Army’s ability to deploy forces to theaters of operation by establishing an early port opening capability that will result in-theater expansion and increased theater sustainment. Furthermore, the Army has expanded its Rapid Fielding Initiative, which accelerates acquisition and fielding processes to ensure that troops deploy with high-priority items. DLA has also expanded its Forward Stocking Initiative by opening a fifth forward stock depot in Kuwait to reduce customer wait time and transportation costs. Moreover, AMC and DLA have formed a partnership in which they will explore the use of commercial systems to increase supply readiness, improve in-transit visibility, cut costs, and improve parts resupply to field locations.

Conclusions

In times of war, the defense supply system needs to be as responsive and agile as the combat forces that depend upon it. In the Quadrennial Defense Review for 2001, DOD stated its intention to transform its logistics capabilities to improve the deployment process and implement new logistics support tools that accelerate logistics integration between the services and reduce logistics demand and cost. OIF tested this system as well as industry’s capability to meet rapidly increasing demands, and, in many instances, the system failed to respond quickly enough to meet the needs of modern warfare. While units in Iraq achieved success on the battlefield, the supply chain did not always adequately support the troops and combat operations. A number of problems prevented DOD from providing supply support to its combat forces at many points in the process, which reduced operational capabilities and forced combat commanders to accept additional risk in completing their missions. An inability to adequately predict the needs of warfighters at the onset of the war, coupled with a slow process for obtaining additional resources once those needs were identified, resulted in critical wartime shortages. In addition, even when sufficient supply inventories were available within the system, they were not always delivered to the combat forces when they needed them. All of these problems were influenced to some extent by a

lack of accurate and timely information needed to support processes and decisions.

Unless DOD's logistics process improves the availability of critical supplies during wartime, combat forces engaged in future operations will likely be exposed to risks similar to those experienced in Iraq. These risks will continue to exist unless DOD is able to improve the availability of war reserve supplies at the start of operations and overcomes problems forecasting accurate wartime demands. Moreover, delays in the Army's funding processes will continue to place U.S. troops at risk by not enabling AMC to swiftly meet surges in wartime demands. In addition, future combat operations may be adversely affected unless DOD is able to anticipate acquisition delays that could affect the availability of critical supplies and provide transparency into how it expects to mitigate production risks. Finally, merely increasing the availability of supplies in the inventory will not help combat forces in the field. Troops will continue to face reduced operational capabilities and unnecessary risks unless DOD's supply chain can distribute the right supplies to the right places when warfighters need them.

While DOD took immediate steps to overcome some shortages, and is beginning to develop solutions to some of the problems identified during OIF, most systemic solutions have tended to center on resolving distribution problems. If supply logistics transformation is to be successful, DOD's supply chain reform will need to include solutions for the full gamut of identified deficiencies contributing to supply shortages during OIF. An integrated approach to addressing all of these deficiencies will increase DOD's potential to achieve responsive, consistent, and reliable support to warfighters, a goal envisioned in the National Military Strategy and its logistics concepts and necessary to support the continued dominance of the U.S. military.

Recommendations for Executive Action

To improve the effectiveness of DOD's supply system in supporting deployed forces for contingencies, we recommend that the Secretary of Defense direct the Secretary of the Army to take the following three actions and specify when they will be completed:

- Improve the accuracy of Army war reserve requirements and transparency about their adequacy by

- updating the war reserve models with OIF consumption data that validate the type and number of items needed,
- modeling war reserve requirements at least annually to update the war reserve estimates based on changing operational and equipment requirements, and
- disclosing to Congress the impact on military operations of its risk management decision about the percentage of war reserves being funded.
- Improve the accuracy of its wartime supply requirements forecasting process by
 - developing models that can compute operational supply requirements for deploying units more promptly as part of prewar planning and
 - providing item managers with operational information in a timely manner so they can adjust modeled wartime requirements as necessary.
- Reduce the time delay in granting increased obligation authority to the Army Materiel Command and its subordinate commands to support their forecasted wartime requirements by establishing an expeditious supply requirements validation process that provides accurate information to support timely and sufficient funding.

We also recommend that the Secretary of Defense direct the Secretary of the Navy to improve the accuracy of the Marine Corps' wartime supply requirements forecasting process by completing the reconciliation of the Marine Corps' forecasted requirements with actual OIF consumption data to validate the number as well as types of items needed and making necessary adjustments to their requirements. The department should also specify when these actions will be completed.

We recommend that the Secretary of Defense direct the Secretary of the Army and Director of the Defense Logistics Agency to take the following two actions:

- minimize future acquisition delays by assessing the industrial-base capacity to meet updated forecasted demands for critical items within

the time frames required by operational plans as well as specify when this assessment will be completed and

- provide visibility to Congress and other decision makers about how the department plans to acquire critical items to meet demands that emerge during contingencies.

We also recommend the Secretary of Defense take the following three actions and specify when they will be completed:

- revise current joint logistics doctrine to clearly state, consistent with policy, who has responsibility and authority for synchronizing the distribution of supplies from the U.S. to deployed units during operations,
- develop and exercise, through a mix of computer simulations and field training, deployable supply receiving and distribution capabilities including trained personnel and related equipment for implementing improved supply management practices, such as radio frequency identification tags that provide in-transit visibility of supplies, to ensure they are sufficient and capable of meeting the requirements in operational plans, and
- establish common supply information systems that ensure the DOD and the services can requisition supplies promptly and match incoming supplies with unit requisitions to facilitate expeditious and accurate distribution.

Matter for Congressional Consideration

To improve visibility over the adequacy of the Army's war reserves, Congress may wish to consider requiring the Secretary of Defense to provide it information that discloses the risks associated with not fully funding the Army war reserve. This report should include not just the level of funding for the war reserve, which is currently reported, but timely and accurate information on the sufficiency of the war reserve inventory and its impact on the Army's ability to conduct operations.

Agency Comments and Our Evaluation

In written comments on a draft of this report, DOD agreed with the intent of the recommendations and cited actions it has or is taking to eliminate supply chain deficiencies. Some of the actions could resolve the problems we identified when completed. Because DOD did not specify dates for completing all of its actions, we modified our recommendations to require specific time lines for their completion. DOD is taking other actions that are not sufficient to fulfill our recommendations and, in several cases the department's comments did not specifically address how it plans to improve current practices. In addition to our evaluation below, we address each of DOD's comments in appendix XI where its complete response is reprinted.

The department cited several actions it is taking to improve the accuracy of war reserve requirements, support prewar planning through supply forecasting, minimize future acquisition delays, and improve supply distribution. However, it did not clearly identify time lines for fully implementing most of these actions. For example, initiatives to improve modeling and data for determining war reserves had no dates for implementation. In some cases, the department provided tentative schedules, such as with the fielding of the Army's Logistics Modernization Program to improve supply forecasting, which it expects to be in full use in fiscal year 2007. In another instance, it provided a May 2006 deadline for the developing an information technology plan to improve distribution, but did not indicate when the plan's recommendations will be implemented. Therefore, we have modified our recommendations to require that DOD specify when these actions will be completed.

In two instances DOD cited actions we do not consider sufficient to fulfill our recommendations. The department stated that its annual Industrial Capabilities Report to Congress, as well as the budget process and other forums, provide adequate information on acquisition of critical items. While we agree that the report provided visibility about some items, such as body armor, it did not identify concerns about acquiring up-armored HMMWVs and kits. Therefore, we do not believe current reporting forums provide Congress with the consistent visibility and information needed to make informed decisions on actions that could speed the acquisition of critical items. In another instance, DOD cites the establishment of the Deployment and Distribution Center in CENTCOM as its means of testing improvements to distribution capabilities. While the center may improve deployable logistics capability, the department did not commit to actions, as we recommended, that would ensure through simulation and field

training that there are sufficient trained personnel and equipment to meet the requirements of the operational plans—a problem in theater before and during the arrival of combat forces. Therefore, we continue to believe these recommendations have merit.

DOD did not commit to any specific action to improve transparency to Congress of the risks associated with inadequately funding Army war reserves. The department said this risk is already reported to Congress in the budget process and a number of other ways. As stated in this report, the methods cited by DOD, such as the budget documentation, do not ensure consistent transparency by clearly stating the operational risks of underfunding the Army war reserves. Therefore we believe our recommendation has merit and have added a matter for congressional consideration that suggests Congress may wish to require DOD to disclose the risks associated with not fully funding the Army war reserve.

While DOD agreed with the intent of three recommendations, it did not commit to any specific actions to address them. The recommendations would (1) ensure item managers are provided operational information in a timely manner, (2) reduce the time delay in granting increased obligation authority to AMC and its subordinate commands, and (3) revise joint doctrine to clarify responsibility and authority for synchronizing distribution. We believe that these recommendations have merit and have cited the reasons in our comments in Appendix XI.

We are sending copies of this report to the appropriate congressional committees; the Secretary of Defense; the Secretaries of the Army and the Navy; the Commandant of the Marine Corps; the Commander, U.S. Central Command; the Commander, U.S. Transportation Command; the Director of the Defense Logistics Agency; and other interested parties.

If you or your staff members have any questions regarding this report, please contact me at (202) 512-8365. Key contributors to this report are listed in appendix XII.

A handwritten signature in black ink, appearing to read "William M. Solis".

William M. Solis, Director
Defense Capabilities and Management

Scope and Methodology

To address our objectives, we employed a case study approach, selecting nine supply items with reported shortages as a way to assess the availability of supplies and spare parts during Operation Iraqi Freedom (OIF). We judgmentally selected the nine items because we believed they presented possible shortages with operational impacts based on our prior work on OIF logistics and other sources such as military “after-action” reports on OIF operations, military and contractor “lessons learned” studies, briefings, congressional testimonies, and interviews with Department of Defense (DOD) and military service officials covering the time period between October 2002 and September 2004. We selected the items to encompass a variety of supply sources and users within DOD, the Army, and the Marine Corps. The items we selected and the supply sources for each item are shown in table 6.

Table 6: Item and Supply Manager

Item	Supply manager
Assault Amphibian Vehicle (AAV) generators	Defense Logistics Agency (Defense Supply Center Columbus) and Marine Corps Logistics Command
Armored vehicle track shoes	Army Materiel Command (Tank-automotive and Armaments Command)
Interceptor body armor	Defense Logistics Agency (Defense Supply Center Philadelphia)
Chemical-biological suits	Defense Logistics Agency (Defense Supply Center Philadelphia)
Lithium batteries	Army Materiel Command (Communications-Electronics Command)
Helicopter rotor blades	Naval Inventory Control Point Philadelphia
Meals Ready-to-Eat (MRE)	Defense Logistics Agency (Defense Supply Center Philadelphia)
Tires for 5-ton trucks and High-Mobility Multi-Purpose Wheeled Vehicles (HMMWV)	Army Materiel Command (Tank-automotive and Armaments Command)
Up-armored HMMWVs and add-on armor kits	Program Executive Office Combat Support and Combat Service Support, Warren, Mich.

Source: GAO.

Note: The Defense Logistics Agency (DLA) became the manager of lithium batteries in October 2004.

To verify the existence of reported shortages and to determine their extent, we interviewed DOD logistics officials and industrial-base suppliers. We also collected and analyzed supply data, such as requirements, customer demands, inventory levels, production levels, back order quantities, and funding levels, for the period between September 2001 through September 2004 for the selected items. We considered an item to be in short supply if the data we obtained showed that demands placed by the warfighter exceeded availability in the supply system. To determine the impact of

shortages for the selected items, we interviewed officials in Army and Marine Corps combat forces that were deployed in OIF and also reviewed DOD and military services' after-action reports, lessons learned studies, readiness reports, and other documents. For a complete list of these organizations, see table 7.

Table 7: Organizations Interviewed during Review

Office of the Under Secretary of Defense (Comptroller), Arlington, Va.
Joint Staff Directorate of Logistics, Arlington, Va.
Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, Arlington, Va.
U.S. Central Command, MacDill Air Force Base, Fla.
U.S. Pacific Command, Camp Smith, Hawaii
U.S. Transportation Command, Scott Air Force Base, Ill.
U.S. Army
Assistant Secretary of the Army for Financial Management and Comptroller, Arlington, Va.
Assistant Secretary of the Army for Acquisition, Logistics, and Technology, Arlington, Va.
Program Executive Office Combat Support and Combat Service Support, Warren, Mich.
Office of the Deputy Chief of Staff (Logistics), Arlington, Va.
Office of the Deputy Chief of Staff (Operations), Arlington, Va.
U.S. Army Central Command/Coalition Forces Land Component Command (Logistics), Fort McPherson, Ga.
U.S. Army Forces Command, Fort McPherson, Ga.
U.S. Army Materiel Command
Office of the Deputy Chief of Staff (Budget Management), Fort Belvoir, Va.
Office of the Deputy Chief of Staff (Logistics), Fort Belvoir, Va.
Communications-Electronics Command, Fort Monmouth, N.J.
Tank-automotive and Armaments Command, Warren, Mich.
Ground Systems Industrial Enterprise, Rock Island, Ill.
Anniston Army Depot, Anniston, Ala.
Lima Army Tank Plant, Lima, Ohio
3rd Infantry Division, Fort Stewart, Ga.
4th Infantry Division & III Corps, Fort Hood, Tex.
101st Airborne Division (Air Assault), Fort Campbell, Ky.

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U.S. Marine Corps

Headquarters Marine Corps, Installation and Logistic Department, Arlington, Va.

Marine Forces Pacific, Camp Smith, Hawaii

Marine Corps Logistics Command, Albany, Ga.

Marine Corps Aviation Supply Logistics Office, Arlington, Va.

Marine Corps Systems Command, Quantico, Va.

1st Marine Expeditionary Force, Camp Pendleton, Ca.

2nd Marine Expeditionary Force, Camp Lejeune, N.C.

3rd Marine Air Wing, Miramar, Calif.

Naval Inventory Control Point Philadelphia, Pa.

National Guard Bureau, Arlington, Va.

Defense Logistics Agency

Defense Logistics Agency Headquarters, Fort Belvoir, Va.

Defense Supply Center Columbus, Ohio

Defense Supply Center Philadelphia, Pa.

RAND Arroyo Center, Santa Monica, Ca.

AM General Corporation, Mishawaka, Ind.

Armor Holdings, Inc. (formerly O'Gara-Hess Eisenhardt), Fairfield, Ohio

Source: GAO.

To determine what deficiencies contributed to identified supply shortages, we interviewed officials and collected documentation from DOD's supply management organizations. On the basis of case studies, we identified deficiencies that affected the supply of two or more of the items. We analyzed data from DOD logistics agencies, operational units, and service and geographic commands to evaluate the significance of these deficiencies to DOD's overall logistics system. We also reviewed prior GAO reports, DOD and military services' after-action reports, military and contractor lessons learned studies, DOD directives and regulations, and reports by DOD and external experts, including Accenture, the Center for Naval Analysis, the RAND Corporation's Arroyo Center, the Science Applications International Corporation, and the U.S. Army Audit Agency. In addition, we analyzed supply data for each item to identify and corroborate deficiencies contributing to item shortages.

To determine what actions DOD has taken to improve the availability of supplies for current and future operations, we collected data from military service and joint command headquarters personnel to identify short- and long-term efforts to address supply shortages. However, we did not evaluate their potential for success. We also reviewed DOD logistics and

strategic planning documents that provide guidance on improving logistics support for military readiness.

We assessed the reliability of the supply data we obtained by interviewing agency officials knowledgeable about the data and corroborated it with other information about supply shortages gathered from other DOD and military service organizations. When data specifically for Iraq were not available, we used worldwide data since OIF received supply priority. With the exception of data on track shoes, we determined that the data were sufficiently reliable for our purposes. In the case of track shoes, we determined that the data provided by the Army's Tank-automotive and Armaments Command (TACOM) were not sufficiently reliable for our purposes and did not use it. However, we were able to identify relevant information from TACOM's periodic reporting to describe the item's supply status. We determined that these data were sufficiently reliable for our purposes. In the case of lithium batteries, the Communications-Electronics Command (CECOM) switched database systems in July 2003. We determined that the data from the new system were sufficiently reliable for the purposes of showing trends and graphing, but we based our findings on program data prior to the system change. We also identified relevant information from other DOD sources to confirm reported shortages of lithium batteries. The limitations of data collected for armored vehicle track shoes and lithium batteries are included in appendixes III and VI, respectively. We also determined that funding data were sufficiently reliable for our purposes by comparing data received from multiple sources within DOD.

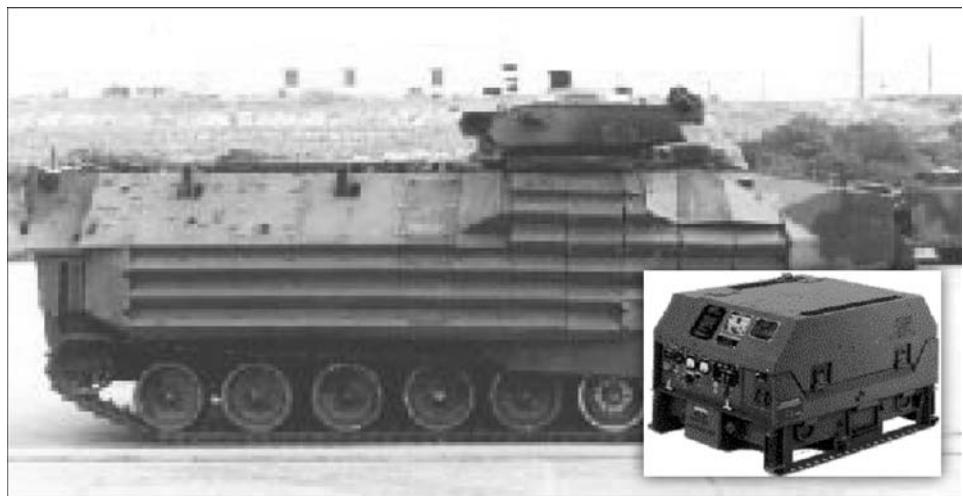
We performed our audit from March 2004 through March 2005 in accordance with generally accepted government auditing standards.

Assault Amphibian Vehicle Generators

Background

The Marine Corps' AAV is a full-tracked landing vehicle designed to carry up to 25 people from ship to shore and is used as an armored personnel carrier on land. The Marine Corps used more than 550 AAVs to transport personnel during operations in OIF. Among the critical parts of the AAV is its generator, which provides needed electrical power (see fig. 6).

Figure 6: Assault Amphibian Vehicle and Generator



Source: DOD.

The supply and distribution of AAV generators is a shared responsibility. The Marine Corps Logistics Command manages the supply of repairable generators; the Defense Supply Center Columbus supplies new generators. During OIF, the 2nd Force Service Support Group was responsible for moving supply shipments from the port to Iraq, and the 1st Service Support Group¹ had responsibility for moving supplies once they reached Iraq. The 3rd Assault Amphibian Battalion, part of the 1st Marine Expeditionary Force, was in charge of maintenance for all AAVs in theater.

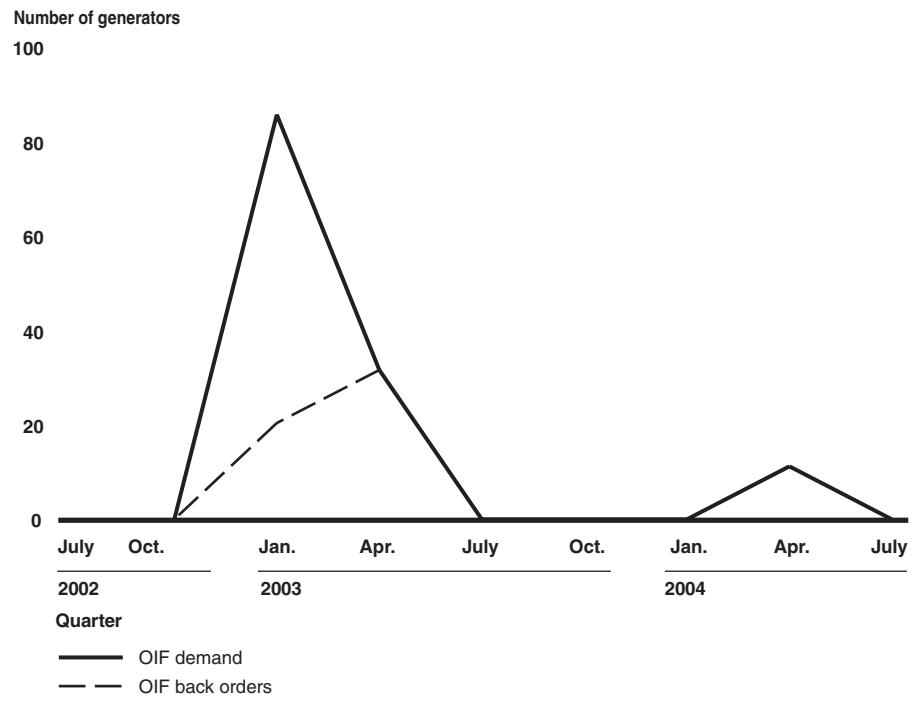
¹ These support groups belong, respectively, to the 2nd Marine Expeditionary Force, which generally provided theater-level supply support for OIF, and the 1st Marine Expeditionary Force, which generally served as the combat force for OIF.

Extent and Impact of Shortages

AAV generators were not available to the warfighter at some point between October 2002 and September 2004. We consider generators to have been a shortage because 84 were ordered, but only 15 were received. The Marine Corps' 3rd Assault Amphibian Battalion experienced a shortage of generators needed to repair AAVs during and after major combat operations in Iraq, according to officials. Both the Marine Corps Logistic Command and GAO have reported that the long distances the vehicles traveled, combined with combat conditions, placed the equivalent of 5 years of wear and tear on the vehicles over a 6- to 8-week period. As a result of this accelerated wear and tear, the vehicles' parts—including generators—wore out quickly. To meet the rapid rise in demand (see fig. 7), the battalion submitted orders for 84 generators between January and June 2003. According to supply management data, the Defense Supply Center Columbus sent 64 new generators and the Marine Corps Logistics Command sent 76 repaired generators²—a total of 140—to the theater during major combat operations. However, the battalion reported that it received only 15 generators. Officials from the 1st Force Service Support Group in Iraq stated they did not know why they did not receive all of the generators shipped from the Marine Corps Logistics Command and the Defense Supply Center Columbus.

² The Marine Corps Logistics Command, Albany, Ga. used repairable generators obtained from its Foreign Military Sales program. Under this program, the U.S. government authorizes the sale or transfer of military equipment, including spare parts, to foreign countries either through government-to-government agreements or through direct sales from U.S. manufacturers.

Figure 7: Assault Amphibian Vehicle Generator Demand and Back Orders for OIF by Quarter (3rd quarter fiscal year 2001 through 4th quarter fiscal year 2004)



While a 3rd Assault Amphibian Battalion official stated their demand for generators exceeded the number received in theater, they did not report any decline in AAV operational readiness. The reported operational readiness of AAVs in the Iraqi theater remained at about 89 percent most of the time between February 2003 and October 2003.³ However, in order to maintain this readiness rate, a 3rd Assault Amphibian Battalion official noted that spare parts from about 40 non-operational vehicles were used to support combat capable vehicles.

³ The operational readiness rate refers to the capability of equipment other than aircraft to perform the mission or functions for which it is organized or designed and may be used in general terms to express a level or degree of readiness.

Causes of Shortages

Poor asset visibility in the Marine Corps' in-theater distribution system contributed to the shortage of generators needed to repair AAVs. Although good asset visibility is one of the main tenets of logistics supply systems,⁴ the Marines had difficulty maintaining visibility over the 140 generators shipped to the theater. Marine Corps Logistics Command and Defense Supply Center Columbus officials tracked generators to the theater, but their visibility over these shipments ended there. Once the generators arrived in theater, the 2nd Force Service Support Group became responsible for maintaining visibility of supply. However, they stated they did not have visibility of the generators shipped into Iraq. The 1st Force Service Support Group, which directly supported units fighting in Iraq, also indicated an inability to track requisitioned supplies. While 15 of the generators were received by the 3rd Assault Amphibian Battalion, neither the Marine Corps' Force Service Support Groups nor we were able to track the remaining 125 generators.

A contributing factor to the shortage of generators was difficulties the Marine Corps faced in maintaining visibility over requisitioned and warehoused spare parts because of incompatible and unstable software and other visibility systems. Before OIF began, the Marines experienced difficulties maintaining visibility over the generators in their in-theater distribution center in Kuwait. Defense Supply Center Columbus officials reported that generators were shipped to the theater to support requirements forecasted by deploying units. However, according to an official with the 3rd Assault Amphibian Battalion, instead of being delivered to the units, generators were warehoused in the distribution center. One reason for the poor asset visibility at the warehouse in February 2003, was the failure of the warehousing software—Storage Retrieval, Automated, Tracking, Integrated System—to work properly. Moreover, the 1st Force Service Support Group used one version of the Asset Tracking Logistics and Supply System (ATLASS) requisitioning software in theater, while the 2nd Force Service Support Group used another version, ATLASS II+. Because the two versions could not interface, personnel of the 1st Force Service Support Group reported that they reentered requisition information manually to move data between the systems. Personnel at the Marine's distribution center in Kuwait entered requisitions into the Supported Activity Supply System, a stand-alone

⁴ *Joint Tactics, Techniques, and Procedures for Joint Theater Distribution*, Chapter I, p. I4, Joint Pub 4.01.4 (Aug. 22, 2000).

inventory system. According to Marine Corps Logistics officials, neither system could track requisitions or parts related to them through the supply requisition process.

In addition, Marine Corps personnel were expected to use radio frequency identification⁵ technology to help maintain asset visibility during supply distribution. According to 2nd Force Service Support Group personnel, Marine units in theater did not have sufficient training or equipment to read the tags in order to support the use of this technology.

Efforts to Improve Availability

Short-term Efforts

When the supply system did not respond to the demand for generators, Marine Corps personnel noted that units went outside the supply system, through e-mail and telephone communications, to locate supplies, such as generators, for AAVs and other equipment.

To minimize data entry errors, Marine Corps personnel developed an electronic process to transfer data between the ATLASS and ATLASS II+ software systems. According to logistics personnel, to improve visibility of requisitions through the system, the Marine Corps streamlined its requisitioning process by using ATLASS to enter requisitions into the Supported Activity Supply System and by eliminating the use of ATLASS II+ in theater.

To support greater use of radio frequency identification tags in theater, the Marine Corps, according to the 2nd Force Service Support Group officials, has provided training to personnel deploying to Iraq and increased the use of the technology to improve asset visibility.

⁵ Radio frequency identification tags are used to track shipping containers and pallets and their contents while in transit. The tags continuously transmit radio signals, which can be read using hand-held or fixed scanners.

Long-term Efforts

According to 2nd Service Support Group officials, the Marine Corps is evaluating an Army information system that monitors assets moving through the supply system to determine if the Army's system can be adapted for Marine Corps use.

The 2nd Marine Expeditionary Force has developed a Marine Air-Ground Task Force Distribution Center initiative. The Marines stated that the initiative, implemented in September 2004, helps them manage the distribution system by bringing together the Traffic Management Office, deployed supply units, and transportation assets to replicate the in-theater supply process. The initiative will enable them to fully replicate the supply system, including the use of radio frequency identification tags and satellite transponders.

Armored Vehicle Track Shoes

Background

During OIF, U.S. forces relied heavily on armored vehicles such as Abrams tanks and Bradley Fighting Vehicles.¹ For example, at the beginning of combat operations in Iraq, the 3rd Infantry Division had a fleet of 252 Abrams tanks and 325 Bradley Fighting Vehicles drawn from Army prepositioned stock. Troops used Abrams tanks to lead attacks in urban areas with the support of infantry equipped with Bradley Fighting Vehicles. Army officials said that Abrams tanks and Bradley Fighting Vehicles were extremely effective for operations in urban terrain. Critical components of both types of armored vehicles are the track that enables the vehicles to move, which are composed of dozens of metal shoes² (see fig. 8).

Figure 8: Abrams Tank Track



Source: TACOM.

¹ Abrams tanks and Bradley Fighting Vehicles are the Army's dominant ground combat vehicles. Both provide mobile firepower while protecting crews from the combat environment.

² Each vehicle has a track assembly that rotates on each side. Each track assembly consists of a number of track shoes attached together to form an endless track. The metal track shoes engage the teeth of the track drive sprockets, which allows power to be transferred from the vehicle to the track. As the sprocket moves the track, it moves the vehicle. An Abrams tank has 156 track shoes; a Bradley Fighting Vehicle has 166.

The Army's TACOM Track and Roadwheel Group buys the track shoes that are used on Abrams tanks and Bradley Fighting Vehicles. Goodyear is the sole source supplier of Abrams track shoes and the major producer of Bradley track shoes. VAREC also produces Bradley track shoes. In fiscal year 2003, TACOM reported spending \$195.2 million to purchase track shoes for all tanks and vehicles. However, worldwide demand for Abrams and Bradley track shoes totaled \$257.4 million. Of the \$195.2 million, TACOM reportedly spent \$98.6 million on Abrams track shoes and \$52.4 million on Bradley track shoes.

We were unable to obtain reliable data on forecasted requirements, demands, back orders, and inventory for track shoes from TACOM's Track and Roadwheel Group. The group's officials told us that because the models and studies used to compute the data can produce inaccurate results, they could not validate the data. As a result, we were unable to document the extent of shortages based on these data. However, group officials were able to provide us with data used to inform AMC on the status of track shoe shortages. According to TACOM, these data are based on information provided by units in theater and best represent true demand. We corroborated this secondary data with classified data and used it in our analysis.

Extent and Impact of Shortages

Track shoes for the Abrams tanks and Bradley Fighting Vehicles were not available to the warfighter at some time between October 2002 and September 2004. We consider this item to have a shortage because demand exceeded the amount of inventory available to meet the needs of the war fighters.

U.S. forces and logistics personnel reported critical shortages of track shoes for Abrams tanks and Bradley Fighting Vehicles during OIF, and these shortages negatively affected their mission. In undertaking their mission, U.S. forces subjected these tanks and vehicles to the equivalent of 3 years of high-intensity training during major combat operations in Iraq. Because of the extensive mileage placed on the tanks and Bradley vehicles—exacerbated by bad road conditions and extreme heat—vehicle parts, particularly track shoes, wore out quickly.

Although TACOM was able to meet the track shoe demands of units preparing to deploy as well as those already deployed in OIF, it began to experience difficulties in providing track shoes to units in theater around April 2003. The demand for Abrams tank and Bradley Fighting Vehicle track

shoes in May 2003 was 5 times the March 2003 forecasted demand (see table 8). To meet the surge in demand for Abrams track shoes, TACOM negotiated with Goodyear to increase the production rate from 15,000 Abrams track shoes per month (from the normal peacetime rate of 10,000 per month) to 17,000 per month for December 2002, then to 20,000 per month in May 2003, and to 25,000 per month in July 2003. However, these increases in production still were not sufficient to meet OIF demands. In May 2003, for example, the actual demand for Abrams track shoes rose to more than 55,000.

Table 8: Forecasted and Actual Demand for Abrams and Bradley Track Shoes (March-May 2003)

	Abrams track shoes	Bradley track shoes
March 2003 forecasted demand	11,125	12,787
April 2003 actual demand	23,462	20,678
May 2003 actual demand	55,313	55,875

Source: TACOM.

As a result of track shoe shortages, some Abrams tanks and Bradley Fighting Vehicles could not operate during the summer months in 2003. For example, the 4th Infantry Division reported it could not obtain sufficient quantities of track shoes to meet operational needs. At one point during post-combat operations, the division had an operational requirement for 23,626 Abrams track shoes, of which 8,002 were shipped, but only 1,028 were received. To support the Bradley Fighting Vehicles, the division had an operational requirement of 29,911 track shoes, of which 4,591 were shipped, but only 744 were received. As a result of its inability to obtain more track shoes and other suspension parts, the 4th Infantry Division reported its readiness rates for both types of combat vehicles deteriorated. For example, one of its brigades reported that 11 of its 44 Abrams tanks were unavailable during post combat operations because of the lack of track shoes.

Track shoe shortages also negatively impacted the 3rd Infantry Division. On June 11, 2003, the division reported that of the 185 Abrams tanks it had on hand, 111 (60 percent) were deemed “non-mission capable due to supply.” For the 237 Bradley Fighting Vehicles it had on hand, 159 (67 percent) were deemed non-mission capable due to supply. According to 3rd Infantry Division officials, the reason tanks and vehicles were

unavailable was because replacement track shoes were not available to the units. For example, between April 16-18, 2003, one divisional supply support activities in Kuwait had 22,074 Abrams track shoes and 18,762 Bradley track shoes on back order.

To alleviate the impact of track shoe shortages on Bradley Fighting Vehicle readiness, theater commanders wanted to bring an additional 1,407 up-armored HMMWVs into theater. However, as detailed in appendix X, the procurement of additional up-armored HMMWVs was also problematic.

Causes of Shortages

Inaccurate war reserves requirements, inaccurate forecasted requirements, and erratic funding affected TACOM's ability to provide track shoes.

Inaccurate War Reserve Requirements

Inaccurate war reserves requirements negatively affected TACOM's ability to provide track shoes to units in theater at the beginning of OIF. Governed by Army Regulation 710-1, war reserves are intended to provide the Army with interim support to sustain operations until it can be resupplied with materiel from the industrial base. For TACOM, the war reserve requirement for 3,635 Abrams track shoes and 1,800 Bradley track shoes identified in September 2001 was not enough to support OIF demands. Although the war reserve requirement increased in December 2002, the new requirement for 5,230 Abrams track shoes and 5,626 Bradley track shoes was still not enough to meet demands.

To more accurately reflect track shoe usage in OIF, TACOM officials, in December 2003, increased the war reserves requirements to 32,686 Abrams track shoes and 34,864 Bradley track shoes. TACOM officials made the change manually rather than using the Army War Reserve Automated Process,³ which was last run in fiscal year 1999. Since then, the number and type of vehicles have changed, but the official process has not been performed again to update the requirements. TACOM officials have been waiting for input based on the defense planning guidance from the Department of the Army to initiate a new process. At the time of our

³ According to Army Regulation 710-1, Chapter 6, paragraphs 6-25 and 6-26, AMC is to compute requirement levels based on guidance from the Department of Army Headquarters using the Army War Reserve Automated Process system. This system is a process that computes requirements for repair parts and minor secondary items and several auxiliary processes that support the requirement process.

review, they were not certain when they would receive the guidance. Until the model is run, TACOM officials will continue to make manual changes to war reserves requirements.

In addition, both we and Accenture have questioned the validity of the Army's war reserve requirements. In a 2001 report, we found that war reserve requirements could be inaccurate because the calculations were not updated to reflect new consumption rates; requirements determination methodology might not be consistent with planned battlefield maintenance practices; and requirements were based on internal estimates of what the industrial-base could provide rather than on well-defined industry data itself.⁴ A 2003 study by Accenture concluded that part of the reason for the low war reserve requirements was that the forecasting process is labor intensive, time consuming, and suffers from inaccurate input data.⁵

Inaccurate Forecasted Requirements

In fiscal year 2003, TACOM underestimated the amount of Abrams and Bradley track shoes needed worldwide. Although TACOM revised its requirements at the end of each quarter, its estimates for Abrams and Bradley track shoes still fell short.

For example, in April 2003 the forecasted monthly requirement for Abrams track shoes was 11,125, which was less than half of the actual demand of 23,462 shoes. The track shoe budget forecasts further illustrate the discrepancy between forecasted and actual requirements. Based on its budget-forecasting tool, TACOM forecasted it would need \$46.8 million for Abrams track shoe purchases for fiscal year 2003. At the end of the year, actual demands for Abrams track shoe totaled \$194.9 million—a 416 percent increase. For Bradley track shoes, the group forecasted it would need \$17.8 million in fiscal year 2003 to meet customer demands. However, actual demands totaled \$62.6 million—a 351 percent increase—by the end of the fiscal year.

⁴ GAO, *Army War Reserves Spare Parts Requirements are Uncertain*, GAO-01-425 (Washington, D.C.: May 2001).

⁵ Accenture, *TACOM Track Study: Findings, Solutions & Recommendations*, December 19, 2003.

Even if TACOM's revised track shoe estimates had been accurate, it would have been too late to meet the summer 2003 demand. In order to have supplies on hand when demands are received, item managers need to award contracts allowing for sufficient procurement lead-time.⁶ TACOM officials explained that track shoe manufacturers need an average of 4 to 6 months to produce and deliver track shoes once they receive a contract. The high demands for track shoes in the late spring and summer of 2003 were not forecasted in October 2002, which would have been the time when contracts should have been awarded so that TACOM could adequately meet customer needs.

The failure to forecast the high demand experienced during the early months of OIF was partly due to the requirements forecasting model used and to the lack of information and guidance provided to TACOM. In its conclusions, the Accenture study on track shoe shortages found that the requirements forecasting model failed to accurately forecast future demands because the model uses a simple moving average based on 24 months of historical demand⁷ that does not support dynamic changes in item usage. This meant that large increases in demand during the last couple of months of the 24-month period would not result in a corresponding increase in the forecasted demand. In addition, TACOM officials stated they did not receive adequate planning guidance on operational plans from AMC prior to the onset of combat operations that they could incorporate into their forecasts for track shoes. Consequently, TACOM determined the requirements based on the model and on the item managers' expertise and knowledge of the item, as allowed under Army Regulation 710-1.

Subsequent requirements throughout fiscal year 2003 also were understated. TACOM officials reported that although they regularly requested information about the track shoes' usage and durability, which would have helped them better gauge actual demand, they received limited information and input from units in the field. As OIF continued throughout 2003, TACOM held teleconferences with AMC Logistics Support Element

⁶ A lead-time is the interval in months between the initiation of procurement action and the item's receipt into the supply system.

⁷ Army Regulation 710-1 states that an active database of the past 24-month demand history should be used to compute future demand. However, the length of the demand base used to forecast requirements can vary from the standard 24 months.

representatives and with units in theater to obtain updated information about item usage.

Erratic Funding for Track Shoe Production

During fiscal year 2003, TACOM did not receive sufficient obligation authority in time to buy track shoes to meet growing demands. TACOM's total funding requirements in fiscal year 2003 amounted to \$257.4 million—\$194.9 million for Abrams track shoes and \$62.5 million for Bradley track shoes. TACOM officials told us that they could not buy sufficient track shoes because they had received only \$216 million in obligation authority to buy all of the items they managed. However, TACOM spent only \$151.0 million on track shoes—\$98.6 million for Abrams tanks and \$52.4 million for Bradley Fighting Vehicles.

In addition to insufficient obligation authority, the uncertainty of the funding flow affected the manufacturer's ability to produce track shoes. A primary producer of track shoes for TACOM, Goodyear, was in danger of closing down its track shoe production plant in April 2003 because of a lack of contracts. TACOM officials stated that they could not award contracts consistently because they did not know how much obligation authority they would receive or when the next allotment would arrive. Because of the acute shortage of track shoes, TACOM immediately awarded contracts to Goodyear whenever obligation authority became available. As a result of accelerated deliveries, Goodyear reported that it had a very low level of remaining workload and was in danger of closing down the track shoe production plant unless it received additional contracts.

According to TACOM officials, additional obligation authority was aggressively requested throughout fiscal year 2003 to support purchases of track shoes as well as other supply items. As an item critical to mission success, officials stated that track shoes usually receive more funding than other commodities managed by TACOM; however, releases of additional obligation authority were delayed in some instances. TACOM officials stated that when they need additional obligation authority, they request it from AMC, which then requests it from Army headquarters. These requests must be validated and justified (based on past sales) at each level before the Office of the Under Secretary Defense (Comptroller) approves for the release of additional obligation authority. TACOM officials expressed frustration with the process and complained that both AMC and Army Headquarters were not aggressively pursuing the issue and did not fully grasp the magnitude of impact to units in theater because of the lack of obligation authority provided to item managers.

Efforts to Improve Availability

Short-term Efforts

To address inaccuracies in war reserve requirements, TACOM has manually updated its requirements levels for track shoes, rather than wait for AMC to implement the next Army War Reserve Automated Process.

To overcome inaccuracies in the requirements forecasting model, TACOM depended on item managers' judgment and expertise to determine demand more accurately. Item managers worked with available information provided by AMC and with input from units in theater. In addition, priority was given to the Iraqi theater of operations and available track shoe production was shipped to support units in Iraq. TACOM worked with theater commanders to expedite and prioritize shipments of track shoes.

To address funding shortfalls, TACOM continually requested that any additional obligation authority be made available to buy track shoes during fiscal year 2003. Because track shoes were considered critical mission-essential items and their shortage greatly impacted theater operations, officials from the Track and Roadwheel Group said that they usually received more funding and attention than other supply groups within TACOM. For example, in June 2003, the Track and Roadwheel Group received \$64 million that was specifically meant to prevent Goodyear from closing down its track shoe production plant. In August 2003, TACOM received an additional \$70 million for track shoe purchases.

To improve track shoe availability during OIF, the Army made a \$5.2 million investment in Goodyear production facilities to meet the surge requirements and to sustain the viability of the track shoe supplier.⁸

Long-term Efforts

At the time of this review, TACOM officials did not identify any long-term efforts to correct problems identified with war reserves, requirements, or funding shortfalls.

⁸ According to the *Annual Industrial Capabilities Report to Congress* in February 2004, Goodyear required an annual minimum production requirement of about 264,000 track shoes to meet its business case.

Interceptor Body Armor

Background

The U.S. military's new Interceptor body armor is composed of two primary components: an Outer Tactical Vest and two Small Arms Protective Insert plates (see fig. 9). The Outer Tactical Vest consists of a combination of a soft fabric vest and para-aramid fiber panels that provide protection against shrapnel and 9 mm ammunition. The plates consist of a combination of ceramic tiles and polyethylene fiber¹ that, when inserted into the vest, provide protection against rifle rounds up to 7.62 mm. The vest accepts two plates, one for the front and one for the back. Additional attachments can increase protection.²

The new body armor provides improved protection and weigh less than the older version—the Personnel Armor System for Ground Troops, or “flak” vest—which protects only against shrapnel. The new body armor weighs 16.4 pounds, while the older vest weighs 25.1 pounds.

Figure 9: Interceptor Body Armor



Source: U.S. Army Natick Soldier Center.

¹ The ceramic tile is composed of various ceramic composites such as boron carbide, silicon carbide, and aluminium oxide. The tile is backed by multiple layers of polyethylene fiber.

² Additional attachments include throat and groin protectors.

The Army planned to issue the Interceptor body armor to U.S. forces over an 8-year period between 2000 and 2007. It began to distribute the armor to military personnel during Operation Enduring Freedom. On the basis of the armor's effectiveness the Army decided to accelerate its fielding for OIF.

DLA's Defense Supply Center Philadelphia manages the Interceptor body armor for the Army. The Marine Corps has its own version of the body armor that is constructed with the same materials as the Army version. The Marine Corps Systems Command and the U.S. Army Robert Morris Acquisition Center manage it for the Marine Corps. Both services rely on the same manufacturers.

Extent and Impact of Shortages

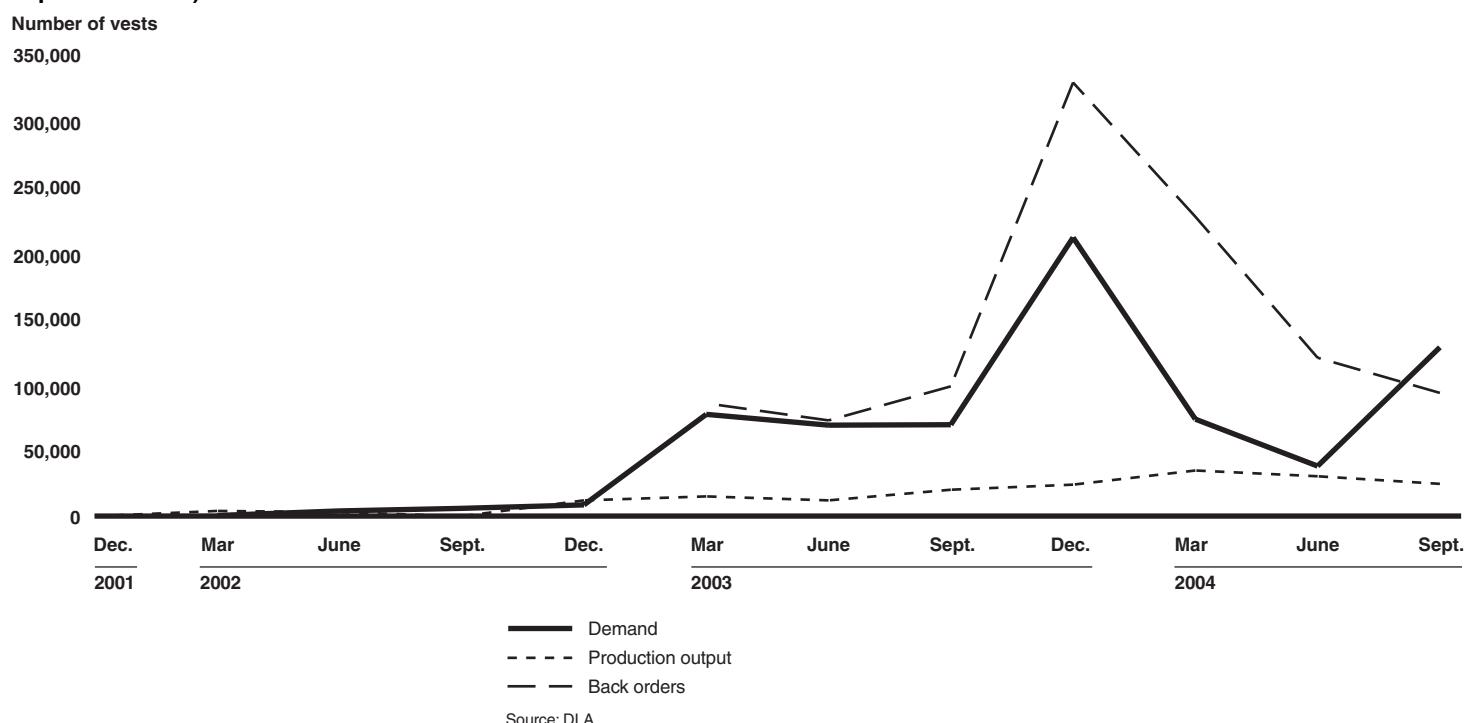
Interceptor body armor was not available in sufficient quantities to U.S. military forces in Iraq sometime between October 2002 and September 2004. We consider this item to have a shortage because demand exceeded the production output necessary to meet the needs of the war fighter. While there were shortages of Interceptor body armor during OIF, Coalition Forces Land Component Command officials stated that military personnel deployed with either the vest component of the new body armor or the old body armor. CENTCOM officials stated that all personnel in Iraq had the new armor by January 2004; 8 months after combat operations were declared over.

The new body armor was initially intended for limited numbers of personnel, such as dismounted infantry, however, this changed during OIF. In May 2003, the Army changed the basis of issue to include every soldier in Iraq. Then in October 2003, CENTCOM further expanded issuance of the body armor to include all U.S. military and DOD civilian personnel working within CENTCOM's area of responsibility including Iraq, Kuwait, and Afghanistan.

Demand for the vest component part of Interceptor body armor increased rapidly both at the beginning of OIF, when troops began combat operations, and again in late 2003 during stabilization operations. Worldwide quarterly demand for vests rose from 8,593 in December 2002 to 77,052 in March 2003—the onset of combat operations. The demand for vests continued to spike upward topping out at 210,783 in December 2003. The number of back orders also rapidly increased over this period of time (see fig. 10). By December 2003 the worldwide number of back orders reached 328,023 with DLA mandating that OIF requisitions receive priority.

In contrast, during December 2003 the number of vests actually produced to meet demand was only 23,900.

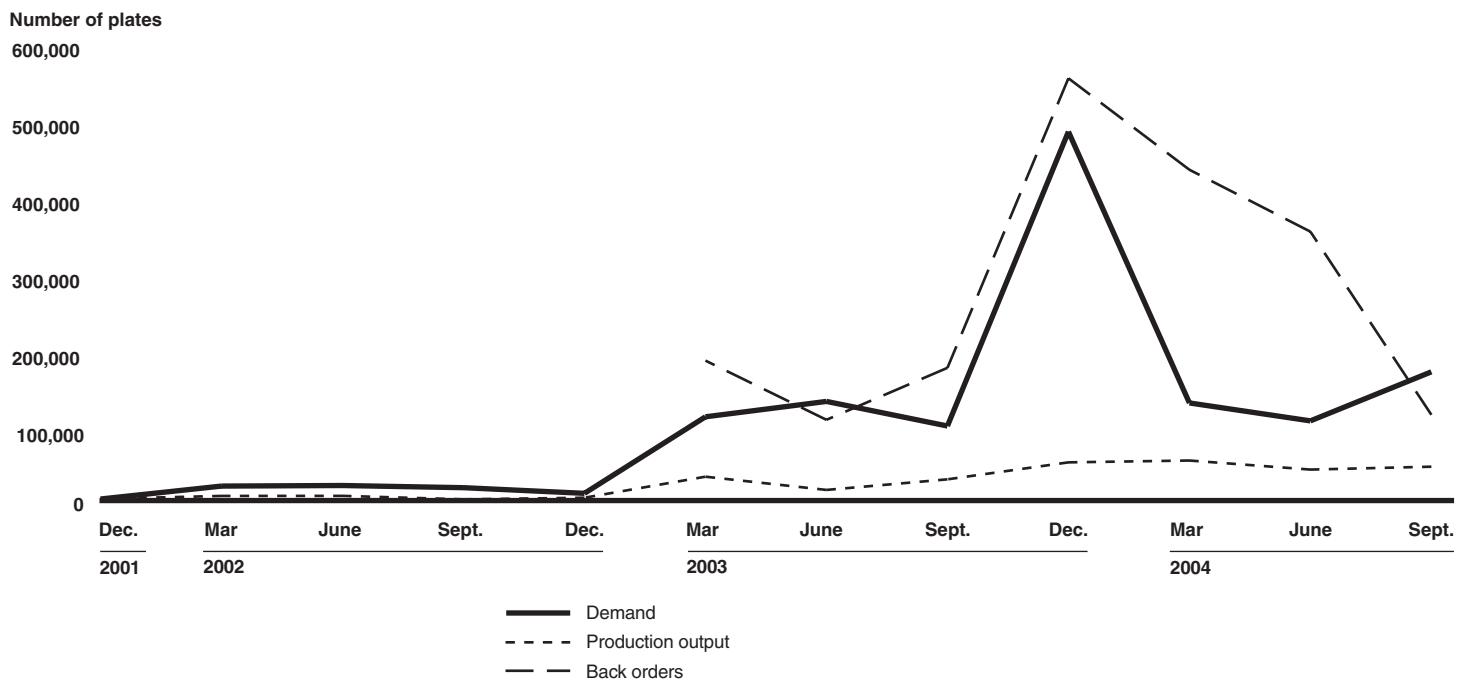
Figure 10: Worldwide Demand, Production Output, and Back Orders for Vests by Quarter (December 2001 through September 2004)



Notes: Back order data were not available for the period between October 2002 and February 2003.

Similarly, the demand for plates increased with the onset of combat operations and again during stabilization operations in late 2003. The demand for plates increased more than ten-fold, from a quarterly demand of 9,586 plates in December 2002 to a quarterly demand of 108,808 plates in March 2003 at the beginning of OIF. As figure 11 shows, with the change in the basis of issue for the Interceptor body armor in October 2003, the demand for plates rose rapidly again, peaking at 478,541 plates in December 2003. In addition, during late 2003, the number of back orders for plates also increased rapidly. By November 2003, the number of worldwide back orders peaked at 597,739 plates, with DLA giving OIF requisitions priority. In contrast, during this month, production output totaled only 40,495 plates.

Figure 11: Worldwide Demand, Production Output, and Back Orders for Plates by Quarter (December 2001 through September 2004)



Note: Back order data were not available for the period between October 2002 and February 2003.

Military officials expressed serious concerns over the shortage of Interceptor body armor. Army officials stated that soldiers' morale declined as units waited for the armor to reach theater. Because of the shortages, CENTCOM officials stated they prioritized the issue of the new body armor to those who were most vulnerable. In addition, there was a lack of body armor among support personnel, such as the Army's 377th Theater Support Command, while insurgents were attacking and interdicting supply routes in Iraq. Because of the shortages, many individuals bought body armor with personal funds. The Congressional Budget Office estimated (1) that as many as 10,000 personnel purchased vests, (2) as many as 20,000 purchased plates with personal funds, and (3) the total cost to reimburse them would be \$16 million in 2005.³

³ The Congressional Budget Office's estimate for H.R. 4200, National Defense Authorization Act for Fiscal Year 2005, p. 16.

Causes of Shortages

Temporary shortages of the Interceptor body armor occurred because of acquisition delays related to lack of key materials and distribution problems in theater.

Lack of Critical Materials Delayed Acquisition

A lack of sufficient quantities of key materials used to make vests and plates delayed acquisition to meet the increasing demand for Interceptor body armor. According to DLA officials, shortages of critical materials still limit worldwide production to approximately 35,000 vests and 50,000 plates per month. A production lead-time of three months has also limited the industrial-base's capacity to accelerate its production levels to meet increasing demand.

DLA officials stated that the production of vests and plates was impaired by a limited availability of critical materials. The shortfall of vests was due to a lack of Kevlar, a para-aramid fiber that was in short supply. DuPont Chemicals is the only domestic producer of the para-aramid fiber panels used in the vests. However, an exception under the Defense Federal Acquisition Regulation Supplement⁴ allowed vest contractors to use Twaron⁵ fiber panels manufactured in the Netherlands as a replacement for Kevlar fiber panels.

The shortfall in ceramic plates was due to insufficient quantities of two materials needed to produce them. The initial shortfall was due to the limited availability of SpectraShield.⁶ Until April 2004, Honeywell was the only domestic producer of SpectraShield, and it had other competing commercial requirements for the material. Plate producers responded to the limited availability of SpectraShield by manufacturing modified plates that replaced SpectraShield with Kevlar and other para-aramid fiber materials. While these plates met ballistic protection requirements, they weighed a half pound more and required a service waiver for acceptance.

⁴ The Defense Federal Acquisition Regulation Supplement, Part 225 governs the acquisition of foreign products and services.

⁵ Twaron is a para-aramid fiber that can be substituted for Kevlar.

⁶ SpectraShield is a polyethylene fiber used as a backing for the ceramic plate and is the only material that meets Army and Marine Corps ballistic protection and weight requirements for the new body armor.

In April 2004, DSM Dyneema, a foreign firm that produces Dyneema, a SpectraShield-equivalent, opened a production facility in the U.S. and began to produce and sell the product. SpectraShield and Dyneema are the only materials that meet the services' ballistic protection and weight requirements for Interceptor body armor. Due to their limited availability, both materials are under Defense Priorities and Allocation System control.⁷ Plate production was later constrained by the limited availability of ceramic tiles. According to DLA, current production output is subject to further increase as DSM Dyneema increases its Dyneema production and additional ceramic tiles are qualified as meeting specification requirements.

**Accelerated Fielding
Affected Distribution**

Attempts to accelerate fielding of the new body armor met with some success, but also caused problems. According to an Army Office of the Inspector General report,⁸ accelerated fielding resulted in supplying body armor to soldiers at a much faster pace than normal. The armor was distributed in some cases virtually directly from the factory to the warfighter. The report stated that the accelerated fielding did not allow time for the project manager to coordinate with units and allow them to establish sufficient accountability in theater, as required by Army regulations. However, lack of in-transit visibility, inaccurate reporting of on-hand quantities, lag time in recording receipt of plates, and other accounting errors resulted in temporary loss of visibility of between 5,000 and 30,000 sets of plates.

⁷ The Defense Priorities and Allocation System assures the timely availability of industrial resources to meet current national defense and emergency preparedness requirements.

⁸ Department of the Army, Office of the Inspector General, *Special Inspection of the Processes Used to Provide Body Armor to U.S. and Coalition Forces in Operation Iraqi Freedom and Operation Enduring Freedom, December 2003-February 2004*, April 20, 2004.

Efforts to Improve Availability

Short-term Efforts

To meet the surging demand for plates, DOD used authority under the Defense Production Act⁹ to allocate production of SpectraShield. More specifically, the Office of the Deputy Under Secretary of Defense (Industrial Policy) used its authority under the Defense Priorities and Allocation System to direct Honeywell to accelerate deliveries of SpectraShield in support of OIF on six occasions in 2003. According to the Acting Under Secretary of Defense (Acquisition, Technology, and Logistics), Honeywell did this at the expense of its commercial orders. To increase industrial-base production capacity, DLA stated that it increased its number of vest suppliers from 1 to 4; plate manufacturers from 3 to 8 (including manufacturers of overweight plates); and ceramic tile suppliers from 4 to 10 (including suppliers of overweight tiles).

Long-term Efforts

DLA has recommended that it have management of Interceptor body armor requirements for all of the services. It has recommended that the services establish war reserve stock levels for the new body armor to mitigate lead-time in industrial-base production. It has also requested the authority to purchase and maintain an inventory of materials necessary for producing vests and plates as well as contract with vendors who have the capacity to use such stored materials during times of high demand.

⁹ The Defense Production Act is the primary legislation for ensuring that industrial resources and critical technology items essential for national defense are available when needed.

Joint Service Lightweight Integrated Suit Technology Suits

Background

JSLIST is a protective clothing ensemble that includes a lightweight chemical-biological protective suit, multi-purpose over-boots, and gloves (see fig. 12). When combined with a chemical protective mask, JSLIST provides protection from chemical and biological agents. The suit can be worn over a uniform and body armor. Once it is removed from the packages, the suit can provide protection for 45 continuous days. However, once exposed to an agent, it must be replaced within 24 hours. The sealed suit package has a shelf life of 14 years. The U.S. military began fielding JSLIST in November 2002. Before then, the Army relied on the Battle Dress Overgarment and the Marine Corps depended on the Saratoga suit.

Figure 12: Joint Service Lightweight Integrated Suit Technology Suit



Source: The Army's Soldier Biological and Chemical Command.

Although the military services manage their own inventories of JSLIST suits, DLA serves as the contracting agent. The largest producer is the National Institute for the Severely Handicapped. The primary subcontractor, Blücher, a German company, makes the suit's filter fabric liner. A critical component of the liner is the carbon beads, which absorb chemical and biological agents. The carbon beads are produced for Blücher—through a sole source contract—by a Japanese company, Kureha.

Extent and Impact of Perceived Shortages during OIF

JSLIST was perceived to not be available for the warfighter between October 2002 and September 2004; however, we do not consider this a shortage because all personnel in theater were issued a JSLIST or Saratoga suit and the required spare by February 22, 2003. Some Army officials in theater, as well as National Guard officials in the U.S., indicated a shortage of JSLIST; however our analysis indicated no actual shortage. Despite this perception of a shortage, neither the Army nor Marine Corps indicated any impact on operational capabilities of deployed units. The Army began to field additional JSLIST suits to units deployed in theater in November 2002, in response to a congressional request.¹ By February 22, 2003, the Army's Central Command reported that every Army unit had two suits for every soldier in theater; moreover, the theater supply base had one spare suit for every soldier. Similarly, the Marine Corps reported it had sufficient stock during OIF to issue one Saratoga suit² and hold two additional suits for each Marine.

Reasons for Perceived Shortages

The perception of a JSLIST shortage emerged in late 2002 and early 2003 because of a change in requirements, poor asset visibility, and concerns about production capacity.

Requirements Changed in Fall 2002

Changes in requirements increased the demand for JSLIST. Before October 2002, the Army's and Marine Corps' requirements called for one chemical-biological protective suit and one backup for each soldier or marine in theater. To meet this requirement, the services planned to use the older suits (e.g., the Army's Battle Dress Overgarment and the Marine's Saratoga suit) and eventually supplemented them with the newer JSLIST. In October 2002, however, the House Committee on Government Reform requested that DOD direct the services to issue JSLIST to all U.S. forces stationed in the Middle East, thereby increasing the servicewide demand for JSLIST. According to Marine Corps officials, this request expanded the number of personnel who needed suits to include not only DOD military

¹ The congressional request was prompted by our finding that DOD could not easily identify, track, and locate defective Battle Dress Overgarments. The Committee's request was subject to available inventories and urgent deployment constraints.

² The Saratoga suit is considered equivalent to the JSLIST in protection against chemical and biological agents. Therefore, the use of the Saratoga suit by the Marine Corps was sufficient to meet the congressional request.

personnel but also DOD civilian contractors and members of other external organizations. Although Marine Corps officials state they planned to provide protective suits for non-military personnel before the congressional request, and had acquired and stocked 400 sets of Saratoga suits for this eventuality, they found more personnel than expected who needed the protective gear. Although the services were required to provide suits for all personnel in theater, there was no DOD policy to guide the procurement of these items.

Although the availability of JSLIST was sufficient, the sizes of the available suits were a problem for some soldiers. Initial orders for JSLIST did not take into account the fact that the suits would be worn over body armor and, thus, larger sizes were needed. According to DLA officials, units also did not consider that some National Guardsmen and reservists would need larger suits than those typically stocked to support the active-duty forces.

Lack of Asset Visibility

In some cases, the poor visibility³ over National Guard and Army Reserve supply inventories affected the perceived nonavailability of JSLIST. For example, Army officials noted that some National Guard and reserve units could not promptly find a sufficient number of JSLIST in their inventory to meet requirements. Their inventory systems did not provide visibility over inventory in different locations.⁴ As a result, Army officials said the deployment of National Guard and reservist personnel was delayed until a sufficient number of JSLIST were located within their inventory.

³ DOD defines visibility as the capability to provide users with timely and accurate information on the location, movement, status, and identity of units, personnel, equipment, material, and supplies.

⁴ GAO, *DOD Business Systems Modernization: Billions Continue to Be Invested with Inadequate Management Oversight and Accountability*, GAO-04-615 (Washington, D.C.: May 27, 2004) found that asset visibility was not maintained over JSLIST suits at the unit level. We also found in GAO, *DOD Management: Examples of Inefficient and Ineffective Business Processes*, GAO-02-873T (Washington, D.C.: June 25, 2002) that DOD's visibility system did not provide accurate information about the quantities and location of JSLIST suits in its inventory.

Production Concerns

Although DLA reported operational unit concerns about the production of carbon beads, the agency was able to meet suit demand during OIF. Because of the single source subcontractor's limited ability to produce carbon beads, the total monthly production was limited to 70,000 to 80,000 suits. DLA officials stated this level of production was sufficient to meet JSLIST requirements and prior GAO analysis supports their claim.⁵ However, DLA officials noted they are concerned about their ability to meet the services' current requirement to replace the 400,000 to 500,000 suits issued in OIF.

Efforts to Improve Availability

Short-term Efforts

To meet the additional requirement to supply DOD civilian contractors and other non-military personnel with JSLIST, Army officials noted that suits were shipped directly to the theater for issue. In addition, Marine Corps officials reported drawing on their prepositioned war reserve stocks to meet the additional requirement.

To meet the demand for larger sizes, the Director of DLA testified that DLA provided 2,000 custom-made suits for personnel outside the original size range.⁶ Moreover, Army officials said that Federal Express was used to expedite the shipment of these suits.

Long-term Efforts

To meet suit requirements for all personnel in theater, Army officials report that DLA has introduced four larger suit sizes into its inventory.

As part of an effort to improve asset visibility, the Department of the Army has implemented an Individual Protective Equipment Centralized

⁵ GAO, *Chemical and Biological Defense: U.S. Ability to Meet Protective Suit Inventory Requirements Faces Risk*, GAO-04-290 (Washington, D.C.:Apr 28, 2004).

⁶ Statement by Vice Admiral Keith W. Lippert, Director of the Defense Logistics Agency, before the Subcommittee on Readiness, House Armed Service Committee, March 30, 2004.

Management Initiative designed to provide units with visibility and shelf-life management of inventory in the United States.

To increase production capability, DLA officials stated that they worked in conjunction with DOD to increase the production capability of the existing industrial base and to develop new protective suits for future use. For example, DLA officials stated that Blücher is conducting research to develop an alternative carbon bead in order to reduce reliance on a sole source producer. In addition, they announced that in June 2004, the JSLIST Additional Source Qualification program at Quantico, Virginia, accepted the use of a new bead from Blücher, which will be available for future suits.

BA-5590 and BA-5390 Lithium Batteries

Background

BA-5590 and BA-5390 nonrechargeable lithium batteries¹ provide a portable power source for nearly 60 critical military communication and electronic systems, including the Single Channel Ground and Airborne Radio System, the Javelin missile guidance system, and the KY-57 transmission security device. U.S. troops depend on these systems to communicate, acquire targets, and gain situational awareness on the battlefield. The BA-5590 was developed specifically for military use more than a decade ago and, according to military officials, is the most widely used communications battery in the supply system (see fig. 13). The BA-5390 served as a substitute battery when shortages of BA-5590s occurred during OIF. Prior to the start of Operation Enduring Freedom, the Army was moving to a rechargeable battery at the direction of the Environmental Protection Agency. Funding was provided for the environmentally safe battery, not the disposable lithium battery. However, these disposable batteries are well-adapted to fast-paced mobile operations because they do not have to be recharged.

Figure 13: BA-5590 Lithium Battery



Source: DOD.

Before OIF, SAFT manufactured all BA-5590 lithium batteries for the U.S. military. In late 2002, Ultralife Batteries started supplying BA-5390s to

¹ These are part of the 5X90 family of lithium batteries. The BA-5590 contains lithium sulfur dioxide (Li/SO_2) cells and has a use-life of about 24 hours. The BA-5390 contains lithium manganese dioxide (Li/MnO_2) cells and has a use-life of about 36 hours. Both batteries have a shelf life of 5 years.

the military and in early 2003 Eagle-Picher Technologies began delivering BA-5590s to augment SAFT's output.

Before and during OIF, CECOM's Logistics and Readiness Center bought and managed DOD's family of lithium batteries. As of September 30, 2004, this responsibility was transferred to DLA's Defense Supply Center Richmond. CECOM, however, will continue to be responsible for technical issues related to lithium batteries.

During the time period covered by our review, CECOM used several methods to derive inventory management data. Before July 2003, CECOM used the old Commodity Command Standard System. We consider data derived from this legacy system to be sufficiently reliable for our purposes. In July 2003, CECOM converted to a new database, the Logistics Modernization Program, which encountered stabilization and data clean-up issues. To overcome these issues, CECOM item managers obtained inventory management information from the Logistics Modernization Program as well as manual computations. While these data are sufficiently reliable for the purpose of showing trends and graphs, our findings rely primarily on data from the Commodity Command Standard System from the period before July 2003.

Extent and Impact of Shortages

Nonrechargeable lithium batteries, specifically BA-5590s and BA-5390s, were available in limited quantities to the warfighter between October 2002 and September 2004. We consider this to be a shortage because the monthly demand and back orders for these batteries exceeded the monthly inventory that CECOM had available to supply U.S. forces in OIF.

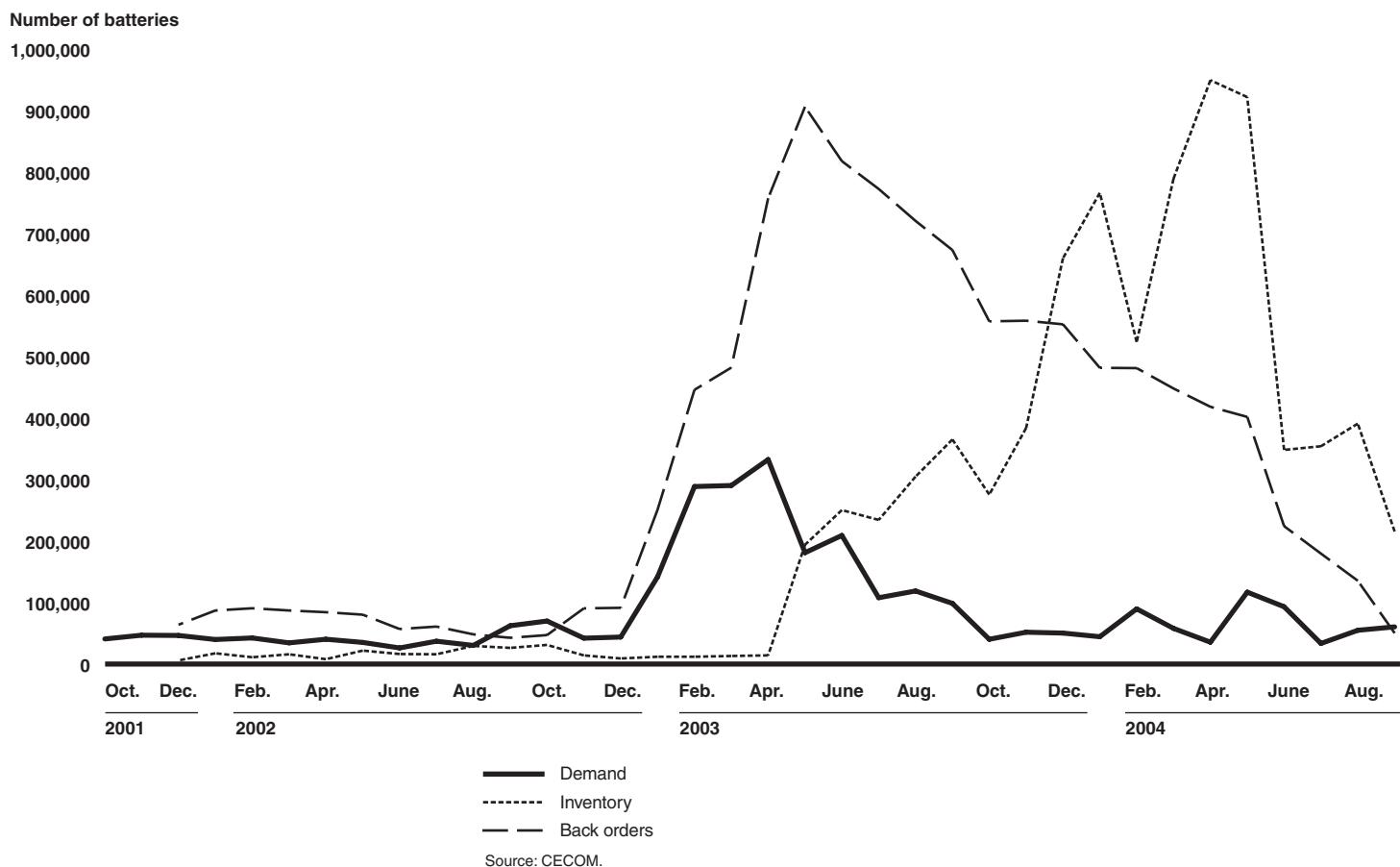
While demand for nonrechargeable lithium batteries increased dramatically after September 11, 2001, it quickly outpaced the available supply, as U.S. troops began preparing for combat operations in Iraq. Demand rose from a peacetime average of below 20,000 batteries² per month before September 2001 to an average of 38,313 batteries per month after the United States launched the global war on terrorism and Operation Enduring Freedom in Afghanistan.³ In January 2003, as thousands of troops

² BA-5590 and BA-5390 batteries are distributed in packages of four batteries. In this report, we use the number of individual batteries.

³ According to CECOM officials, demand represents worldwide demand.

were deploying to the Gulf region, the number of batteries requisitioned surged to 140,000 and, in April 2003 during major combat operations, the number peaked at 330,600 (see fig. 14). When major combat operations were declared over in May 2003, demand began to fall. Since the fall of 2003, the demand has leveled off to an average of about 62,000 per month.

Figure 14: Worldwide Demand, Inventory Levels, and Back Orders for BA-5590 and BA-5390 Lithium Batteries by Month (October 2001 through August 2004)



Note: Data on inventory and back orders was not available for October and November 2001.

U.S. troops encountered severe shortages of nonrechargeable lithium batteries because inventory levels (including on-hand and war reserve stocks) were low. As figure 14 shows, inventory levels remained on average below 15,000 batteries during 2002 and into early 2003, increasing only in

May 2003 after major combat operations were declared over and demand began to decline. At the same time, the number of back-ordered batteries grew to about 250,000 in January 2003 and, by May 2003, had nearly quadrupled to 900,000. As demand fell and requisitions were filled, the number of back orders began to drop in the summer of 2003 and, by the end of 2003, inventory levels exceeded back orders.

Army and Marine Corps units faced critically low supplies of BA-5590s and BA-5390s during the spring of 2003. On March 24, 2003, a few days after combat operations began, the Marines reported they were down to less than a 2-day supply (rather than the required 30-day, on-hand safety level). In early April, Marine officials projected that, given existing worldwide inventories, production capacity, and consumption rates, they would experience degraded communications capacity by early May if the war continued at the same pace. To mitigate the shortages, the military took some actions, including requiring stationary units to use alternative power sources (e.g., rechargeable batteries) and instituting a weekly Materiel Priority Allocation Board⁴ meeting to apportion batteries to combat units that needed them the most.

Causes of the Shortages

The critical shortages of BA-5590s and BA-5390s during OIF resulted from four related conditions: inadequate war reserve requirements, inaccurate forecasted requirements, lack of full-funding, and acquisition delays due to industrial-base limitations.

Inadequate War Reserve Requirements

The Army's war reserve requirements for nonrechargeable lithium batteries were not sufficient to support initial operations. According to Army Regulation 710-1, the war reserve is intended to provide the Army with interim support to sustain operations until it can be resupplied with material from the industrial base. According to CECOM officials, before OIF, the war reserve requirement for BA-5590s was set at about

⁴ The Joint Materiel Priorities and Allocation Board—which performs duties for the Chairman, Joint Chiefs of Staff—sets, changes, or recommends priorities for allocating supplies in the DOD system when competing requirements among DOD components cannot be resolved.

180,000 batteries to sustain the first 45 days of war.⁵ However, this amount was considerably below the actual demand of nearly 620,000 batteries recorded during March and April 2003. Officials stated that the low pre-war requirement was generated by the Army's war reserve model,⁶ which was last updated in 1999; moreover, this model used inaccurate battery failure rates and did not include all of the equipment that used nonrechargeable lithium batteries. Based on their experience during OIF, CECOM officials have increased the current Army and Marine Corps war reserve requirement for BA-5590s and BA-5390s to more than 1.5 million total batteries, an amount equal to OIF's average monthly demand of 250,000 batteries times 6 months of continuous combat operations. War reserve planners expected inventories to reach the 1.5 million mark by February 2005.

Inaccurate Forecasted Requirements

In addition to low war reserves, CECOM's official monthly forecasted requirements for nonrechargeable lithium batteries were far below those needed to meet a wartime contingency. Forecasted requirements are developed primarily on the basis of actual demand data for an item from the preceding months⁷ and are used to support funding requests to purchase additional supplies. In 2002, CECOM increased its monthly forecasted requirements from a monthly peacetime norm of 24,000 batteries to a monthly average of 36,000 in response to the global war on terrorism (see fig. 15). These monthly requirements grew to nearly 60,000 in March 2003 when combat operations began in Iraq, but this number was only one-fifth of the actual demand recorded that spring. Forecasted requirements continued to lag behind demand until mid-summer when they caught up. According to officials from Central Command Joint Logistics, the pre-OIF monthly requirement figures were low because some combatant commanders did not submit their requirements and estimates did not reflect all battery usage; as a result, officials said that calculating requirements was purely guesswork.

⁵ BA-5390s were not part of the pre-OIF war reserve inventory because the U.S. military did not use them until the fall of 2002.

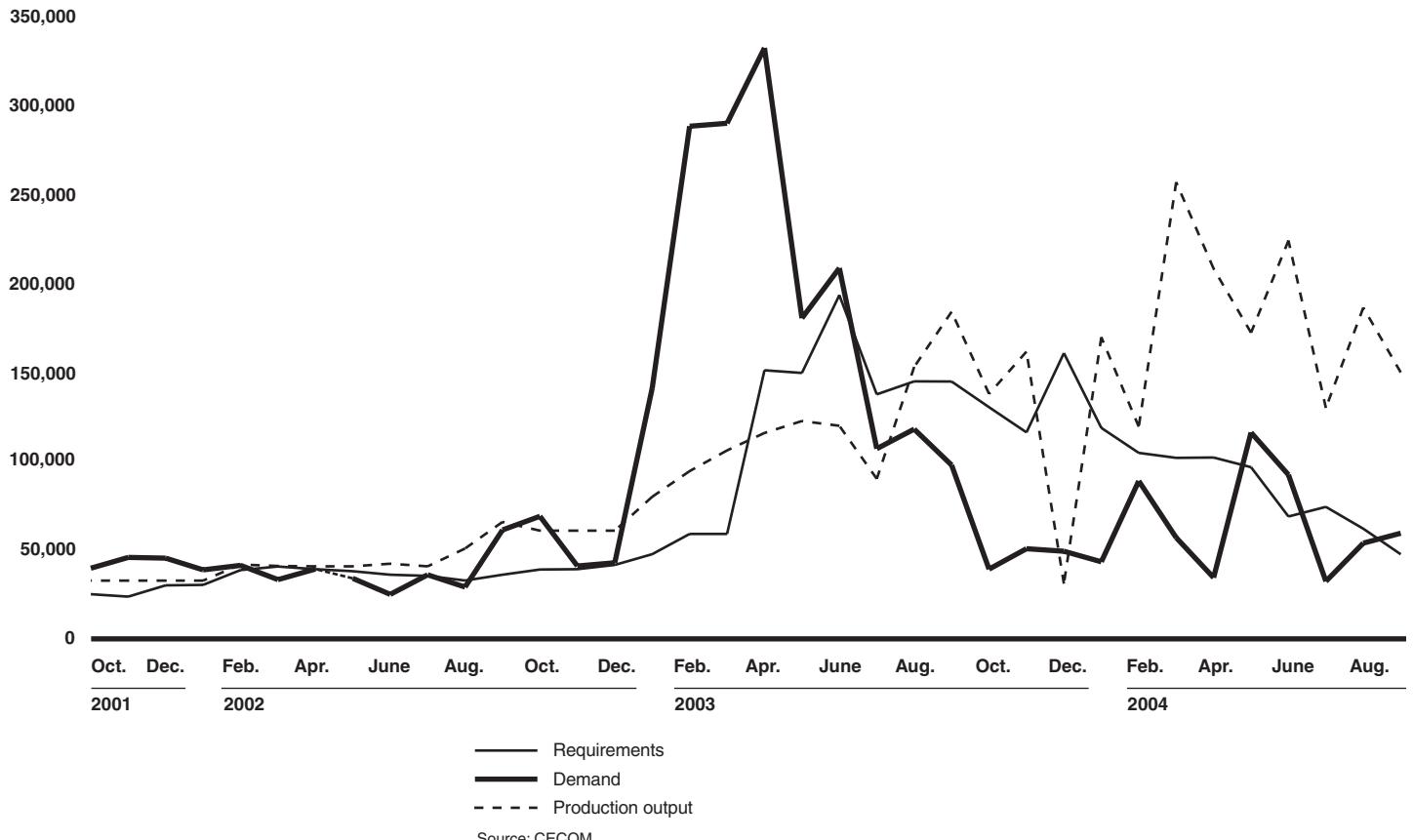
⁶ Army War Reserve Automated Process computes requirements for secondary items, such as spare parts, for the war reserve.

⁷ CECOM's change in the demand base to 6 months was reflected in the April 2003 forecasted requirements.

Appendix VI
BA-5590 and BA-5390 Lithium Batteries

Figure 15: Worldwide Forecasted Requirements, Demand, and Production Output for BA-5590 and BA-5390 Lithium Batteries by Month (October 2001 through August 2004)

Number of batteries



Source: CECOM.

Notes:

- (1) The jump in forecasted requirements in April 2003 was the result of reducing the demand base to 6 months to calculate requirements.
- (2) According to CECOM, fluctuations in production output after July 2003 reflect changes in deliveries from one month to the other.

In the summer of 2002, CECOM and AMC officials developed a more realistic contingency requirement for nonrechargeable lithium batteries. Using information from the Operation Plan and other sources, they forecasted a need for 300,000 to 325,000 batteries per month.⁸

⁸ CECOM officials stated that this figure included a Marine Corps requirement.

As figure 15 shows, this estimate closely paralleled the actual demand of 330,000 at the height of major combat operations in April 2003. CECOM officials presented this requirement to AMC and the Joint Materiel Priorities and Allocation Board in the fall of 2002 to bolster their request for \$38.2 million of additional obligation authority to ramp up BA-5590 and BA-5390 production. They received the funding in early December 2002.

Army Decisions Did Not Provide Full Funding for Batteries

The Army's risk-based decision not to fund full requirements for CECOM, particularly lithium nonrechargeable batteries, during several years prior to OIF compounded the shortage problem. As table 9 shows, CECOM had unfunded requirements ranging from \$85 million to \$419 million for the 3 fiscal years up to and including OIF. In fiscal year 2003, for example, CECOM identified requirements for the command of nearly \$1.5 billion, but received less than \$1.1 billion in obligation authority for the year, resulting in an unfunded requirement of \$419 million, or more than 28 percent of the total amount required.

The command's unfunded requirements specifically for BA-5590 lithium batteries varied from a high of \$4.2 million in fiscal year 2001 to a low of \$1.2 million in fiscal year 2002. However, the low figure for fiscal year 2002 occurred because AMC directed CECOM to spend \$11.5 million to specifically support its BA-5590 requirement. Our analysis shows that even if CECOM had been able to fund 100 percent of its BA-5590 battery requirement in fiscal year 2002, it would not have been able to meet the growing demands from the global war on terrorism. A fully funded requirement (\$22.6 million) would have provided about 33,000 batteries per month, and actual demand exceeded that for most of the year.

Table 9: CECOM Unfunded Requirements for Fiscal Years 2001 through 2003

Dollars in millions

	Fiscal year		
	2001	2002	2003
CECOM requirements	498	568	1474.7
CECOM unfunded requirements	85	207	419
Percent unfunded	17.1%	36.4%	28.4%

Source: CECOM and AMC data.

Acquisition Delays Due to Industrial-Base Limitations

The surge in demand for nonrechargeable lithium batteries exceeded the amount that the industrial base could produce, thereby delaying acquisition. Before OIF, CECOM had contracted with only one qualified producer, SAFT, to make BA-5590s. To support the global war on terrorism, SAFT doubled its production from 32,000 batteries per month in October 2001 to 60,000 per month in September 2002. After receiving \$38.2 million in additional obligation authority in December 2002, CECOM increased its orders for BA-5590s with SAFT and added BA-5590s to its contract with Eagle-Picher. It also contracted with Ultralife to make a substitute battery, the BA-5390. According to CECOM officials, both batteries have a 6-month production lead time.⁹ Despite CECOM's efforts, the long lead-time precluded the ability of these three producers to meet the surge in demand during major combat operations. Army officials stated that if they had received funding earlier they would have been able to mitigate the effects of this long lead time. As figure 15 shows, while production output increased to over 100,000 batteries per month in the spring of 2003, it did not approach 200,000 until the late summer of 2003 or reach its peak of 250,000 until early in 2004.

A recent study identified a limited industrial base as the primary cause of the BA-5590 battery shortage. A March 2004 Science Applications International Corporation report concluded that battery shortages and lack of availability were an industrial-base challenge.¹⁰ The supplier was not able to increase production to meet the unforeseen six-fold increase in demand.

Efforts to Improve Availability

Short-term Efforts

To overcome production constraints, CECOM negotiated with two other producers, in addition to SAFT, to manufacture BA-5590s and BA-5390s. It also worked with the three producers to augment battery production by

⁹ According to CECOM this relatively long lead-time includes time for testing.

¹⁰ Science Applications International Corporation (SAIC), *Objective Assessment of Logistics in Iraq* (March 2004).

going to a 24/7 schedule. In addition to expedite shipments, CECOM had SAFT bypass the depot and ship batteries directly to Charleston Air Force Base for air shipment to the theater. According to CECOM, a capital investment of \$5 million was made in the three producers in May 2003 to expand their production capacity.

DOD took a number of actions to get the limited supply of nonrechargeable batteries to units that needed them most. According to CENTCOM, the Joint Chiefs of Staff issued a directive to send all available BA-5590s and BA-5390s to CENTCOM's area of responsibility until June 2003. The Joint Staff also put these batteries on the "critical few list," which focused attention on improving the availability of specific items the services and geographic combatant commands reported as critical to their worldwide operations. CECOM and Marine Corps officials said they shifted available batteries from military installations worldwide and also bought batteries on the commercial market. The Army, Marines, and Coalition Forces Land Component Command also directed troops, especially those in rear units, to use rechargeable batteries when possible. In addition, the Army required soldiers to use rechargeable batteries for garrison duty and training and to maximize their use during peacekeeping operations. Marine combat units were instructed to do everything possible to reduce nonrechargeable battery consumption rates. Moreover, Coalition Forces Land Component Command was appointed the theater's item manager for batteries, with responsibility for prioritizing and releasing batteries to units.

Long-term Efforts

To correct problems with war reserve requirements, CECOM officials said they set the current war reserve requirement for BA-5590s and BA-5390s to more than 1.5 million batteries to better reflect the experiences in OIF. This requirement was expected to be filled by February 2005.

To improve battery availability, the Deputy Under Secretary of Defense for Logistics and Materiel Readiness, in January 2004, directed the transfer of battery inventory management from CECOM to DLA as of September 30, 2004.

In terms of technological efforts, CECOM officials said they are developing newer, lighter-weight rechargeable batteries that could be powered by solar panels or other energy sources while troops are on the move to reduce dependence on disposable batteries.

Marine Corps Helicopter Rotor Blades

Background

During Operation Iraqi Freedom, the Marine Corps relied on a variety of helicopters to support its forces during combat operations. These include the UH-1N Huey, a twin-engine utility helicopter used in command and control, re-supply, casualty evacuation, liaison, and troop transport, and the CH-53E Super Stallion, a triple-engine cargo helicopter used to transport heavy equipment and supplies. Both types of helicopters require numerous spare parts, including rotor blades, to maintain their operational status (see fig. 16). In Iraq, Marines reported that enemy fire and harsh environmental conditions, such as heat, sand, and unimproved airfields, increased the wear and tear on the rotor blades.

Figure 16: Rotor Blades on CH-53E Super Stallion



Source: DOD.

All Marine Corps helicopter spare part supplies, including rotor blades, are managed by the Naval Inventory Control Point Philadelphia.

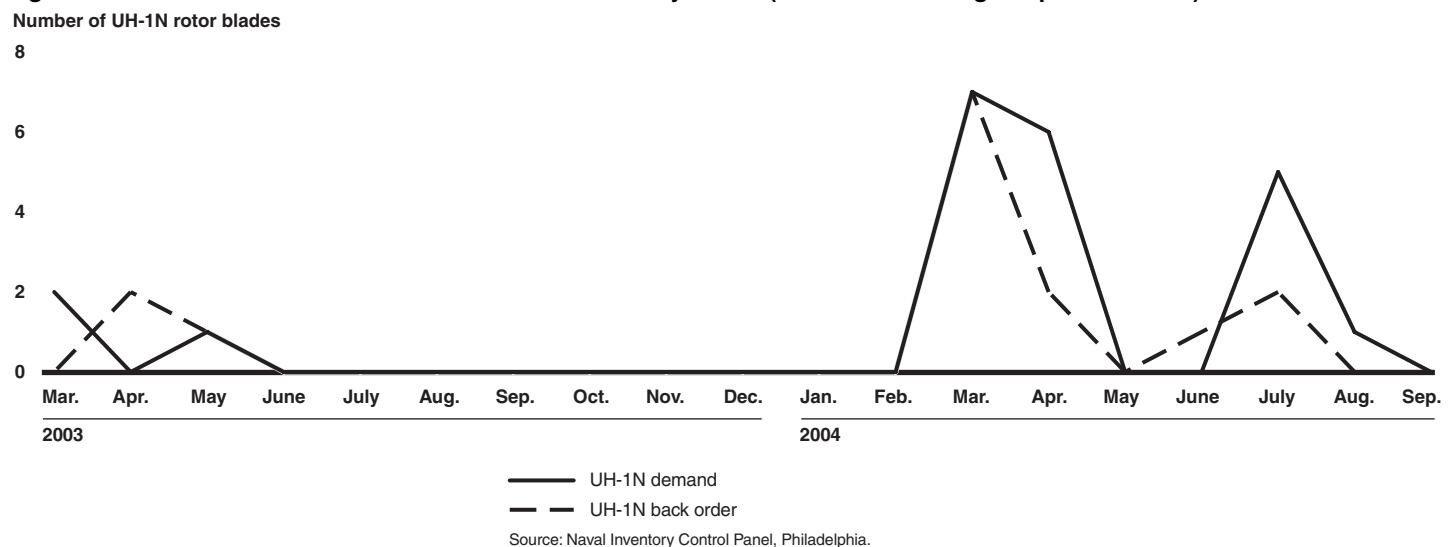
No Supply Shortages Existed During Operation Iraqi Freedom

There were no shortages of rotor blades between October 2002 and September 2004, although there were indications of concern due to increased wear and tear caused by operating from unimproved airfields, the harsh environment, and back orders. We do not consider this a shortage because the supply system filled back orders within 2 months and Marine Corps officials from the 3rd Marine Air Wing reported no major supply shortages of rotor blades for the UH-1N and CH-53E helicopters during OIF.

The supply system was able to provide a sufficient replacement quantity of UH-1N and CH-53E rotor blades despite increased demands. For example, the Marine Corps took the forecasted 16 UH-1N helicopter rotor blades, to Iraq. As figure 16 shows, from March 2003 through August 2004, the Marines requisitioned 22 additional rotor blades to support their mission, and the supply system met those demands by filling orders within 2 months of receiving the order.

In addition, air wings from outside the theater supported the demand in Iraq by providing rotor blades from various air stations, ship supply, and Marine Aviation Logistics squadrons. As a result, the Marines were able to maintain a mission capable rate for the UH-1N of 75.4 percent during OIF,¹ compared with a peacetime rate of 79.9 percent in 2000.² To date, the Naval Inventory Control Point Philadelphia continues to meet UH-1N rotor blade demands for OIF.

Figure 17: UH-1N Rotor Blade Demand and Back Orders by Month (March 2003 through September 2004)

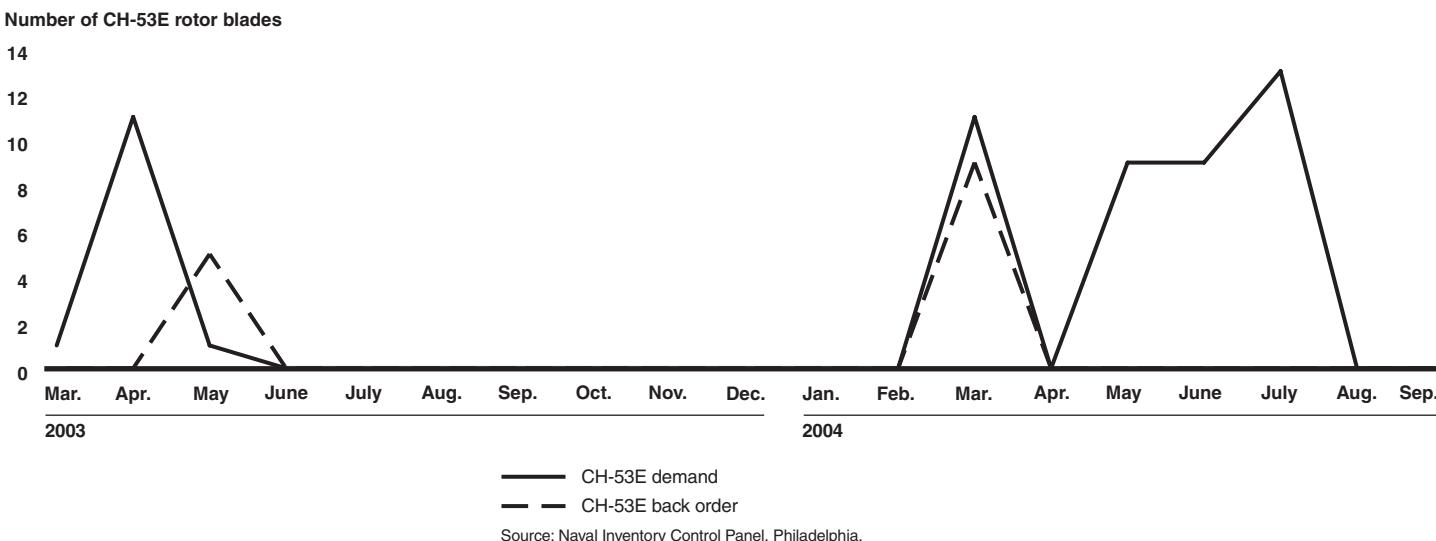


¹ Mission capable is defined as the material condition of an aircraft indicating it can perform at least one and potentially all of its designated missions.

² The Marine Corps provided fiscal year 2000 as a representative peacetime year.

The 3rd Marine Air Wing took 33 of the forecasted requirement of 64 rotor blades to support CH-53E helicopters in Iraq. As figure 18 shows, 55 additional rotor blades were ordered through the supply system, with 14 on back order from March 2003 through September 2004. The supply system met those demands by filling orders within 1 month of receiving the order. As a result, the Marines were able to maintain a mission capable rate for the CH-53E helicopter of 67.5 percent during combat operations, compared with a peacetime rate of 72.3 percent in 2000.

Figure 18: CH-53E Rotor Blade Demand and Back Orders by Month (March 2003 through September 2004)



Marine Corps officials stated that there were no shortages of rotor blades for UH-1N and CH-53E helicopters and our analysis of the 3rd Air Wing's demand and the supply system's ability to promptly provide rotor blades during OIF supports their assertion.

Efforts to Maintain Rotor Blade Supply

Short-term Efforts

Even though they were able to get enough rotor blades from the supply system to meet their demands, Marines took a number of actions during OIF to extend the life of rotor blades in theater. Marines improved the durability of CH-53E rotor blades and other bladed helicopter parts by coating them with titanium paint and a tape covering in order to protect the leading edge of the blade from sand erosion. In addition, as the pace of combat operations slowed, Marines built permanent airfields with paved landing areas, which decreased blade erosion during take-off and landing.

Long-term Efforts

The Marine Corps and Naval Inventory Control Point Philadelphia attribute their ability to provide rotor blades to using models to determine numbers and timing of spare parts and upgrades to sustain helicopter operations. The Marine Corps and the Naval Inventory Control Point Philadelphia maintain a 5-year old system, the Common Rate Calculation System/Common Application Development System, which uses 4-year historical demand data for the entire aircraft community for particular helicopters, engineering data and worldwide environmental factors to produce more accurate demand projections.

Meals Ready-to-Eat

Background

The standard military ration for the individual combatant is a prepackaged, self-contained ration known as a MRE (see fig. 19). A MRE consists of 1,300 calories per bag and is designed to sustain an individual engaged in heavy activity, such as military training or actual military operations, when normal food service facilities are not available. MREs are issued in cases of 12 and MREs have a shelf life of 3 years when stored at 80°F.

Figure 19: Meal Ready-to-Eat



Source: DLA.

DLA's Defense Supply Center Philadelphia manages the MRE supply for all services. It has supplied a total of 5.1 million MRE cases for OIF.

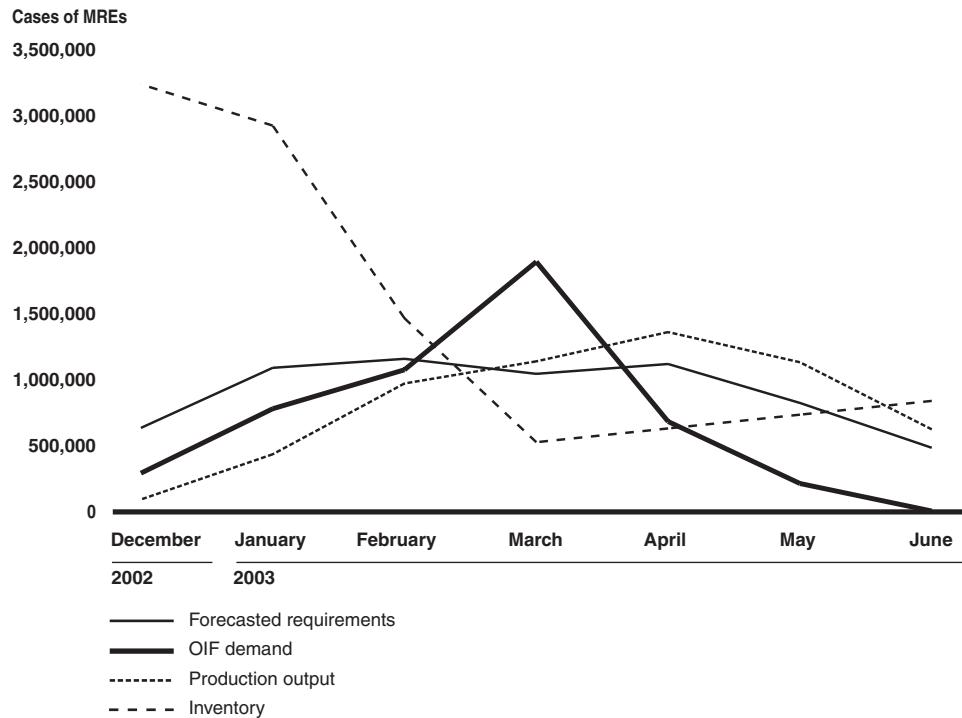
Extent and Impact of Shortages

MREs were not available to the warfighter at some point between October 2002 and September 2004. We consider this item to have a shortage because demand exceeded the amount available to meet the needs of the warfighters.

As figure 20 indicates, as the demand for MREs in OIF grew between December 2002 and March 2003, the worldwide inventory declined. A shortage of MREs began in February 2003 and continued into March 2003 when monthly demand peaked at 1,810,800 cases, although only 500,000 cases were available in the inventory. Figure 20 also shows the production output of MREs increased from December 2002 through April 2003. As a result of DLA's actions to maintain an industrial base capable of a large surge in production, the industrial base was able to increase its monthly production of MREs.¹ Consequently, DLA never reported any back orders for MREs during OIF. In late April 2003, as U.S. forces transitioned from MREs to other food consumption options, monthly demand decreased significantly to 650,000 MRE cases. That month, the industrial base produced 1.3 million cases. From May 2003 on, a sufficient quantity of MREs were available in inventory to meet demand.

¹ After Desert Shield/Desert Storm, DLA established a "War Stopper" program to ensure sufficient wartime surge capacity for critical items. It took preemptive steps, such as establishing surge contracts and investing funds in equipment and facilities, to ensure that these items would be available in sufficient quantities during contingency operations.

Figure 20: Forecasted Requirements, OIF Demand, Production Output, and Inventory for MREs (December 2002 through June 2003)



Source: DLA.

Army and Marine Corps units did not always have all the MREs they needed. According to CENTCOM after-action reports, Army combat units were supposed to arrive in theater with a 7 to 10 day supply of MREs. However, CENTCOM reported that many units did not arrive with this quantity, thereby placing a strain on the in-theater inventory. An analysis of Army logistics reports by the RAND Corporation indicated that some units came within 2 days or less of exhausting on-hand quantities. According to the 2nd Force Service Support Group, Marine Corps combat units averaged a 6- to 8-day supply throughout the war, but there were times when some forces had less than 1-day on-hand supply. Marine Corps' Combat Service Support Companies, which directly support combat units, also reported critical shortages of MREs. According to the 1st Force Service Support Group, direct support units were supposed to maintain a 2-day supply. However, according to a study by the Center for Naval Analysis, there were times in late March and mid-April 2003 when direct support units had less than a 1-day supply.

Causes of Shortages

Problems with requirements planning, the release of Operations and Maintenance funding,² and distribution contributed directly to shortages of MREs in theater.

Requirements Not Accurately Forecasted

DLA's forecasted requirements did not support MRE customer demand for the first month of combat operations because of rapid changes in the size of troop deployments. DLA's forecasted requirement for March 2003 was 996,556 cases of MREs; this number fell short of meeting the customer demand of 1,810,800 cases. The March 2003 forecasted requirement did not include data that anticipated initial in-theater personnel levels would be doubled because of a faster deployment of certain units. In a lesson-learned report, CENTCOM stated that the forecasted MRE requirement for the period of deployment was predicated on a 30-day supply for 50,000 personnel. This forecast was quickly exceeded by the deployment of 100,000 personnel during that 30-day period. The resulting demand placed a strain on existing in-theater MRE inventories. However, DLA's model provided accurate planning estimates for MRE customer demand for all other months.

Funding Was Not Available When Needed

The Army experienced a delay in the release of operations and maintenance funding for MREs, despite DOD requirements that supply chain processes provide timely support during crises. Although the Army wanted to submit MRE requisitions to DLA in September 2002, it could not do so because it lacked the Operations & Maintenance funding necessary to purchase them. When the Army submitted the requisitions in December 2002, DLA shipped MREs to Kuwait. However, this 4-month delay in funding contributed to the shortage of MREs by delaying shipments of MREs into the theater.

The Marine Corps faced a similar funding problem that delayed the processing of ration requests for OIF. As reported in a Marine Corps lessons-learned report, a January 6, 2003, request for a withdrawal of rations from the war reserve was delayed due to lack of available operations and maintenance funding from Headquarters Marine Corps. The Marine Corps provided notification of partial funding and the Marine

² The operations and maintenance budget covers the costs of purchasing supply items associated with carrying out military operations.

Corps' first request for rations was passed to DLA on January 16, 2003. Funding was available to provide for the remainder of the requirement and funded requisitions were passed to DLA on February 10, 2003, 5 days before the Marines' required delivery date of February 15, 2003.

Numerous Distribution Problems Impeded Supply

A number of distribution problems in the logistics supply chain hampered MRE availability.

Inaccurate Delivery Time Forecasts

One problem was that actual MRE delivery times exceeded the forecasted delivery times. Most MREs were transported by ship from the U.S. to a seaport of debarkation in theater and then by ground transportation to combat units. CENTCOM officials estimated it would take 30 to 45 days to transport MREs from the United States to a warehouse in theater. However, they stated that the actual total time to move these rations averaged 49 days: 31 days for transit to the theater, 3 days to gain a berth at port, 5 days to discharge supplies, and 10 days for movement from the port to the theater warehouse. Officials also noted that there were times when it took as long as 60 days to transport MREs from the United States to Kuwaiti ports because multiple, rather than single, vessels were used in the transport process—a factor that initial delivery time estimates did not take into account.

Limited Materiel Handling Equipment and Transportation Assets

The lack of sufficient materiel handling equipment³ and transportation assets in theater up to and during combat operations caused delays in unloading supplies from ships and transporting them to combat units. Because of the lack of adequate handling equipment, logistics personnel could not efficiently unload the large shipments of MREs arriving at ports in Kuwait, resulting in a backlog of ships waiting to be unloaded. DLA officials stated that, at one point in time, 1.4 million MREs were sitting at a port in theater, waiting to be processed. In addition, there were insufficient transportation assets to move MREs from ports to theater distribution warehouses. In particular, local contractors responsible for delivering rations did not have sufficient trucks to make regular deliveries to theater distribution warehouses. In addition, there were insufficient materiel handling equipment and transportation assets to move MREs from storage

³ Materiel handling equipment refers to mechanical devices that allow supplies to be handled easily and economically to, through, and from production facilities, in warehouses and storage, and in receiving and shipping areas.

locations to combat units. For example, according to one OIF after-action report there were times when 80 trucks were needed to move rations forward but only 50 were available.

Poor In-transit Visibility

Poor in-transit visibility also delayed distribution of MRE shipments in several ways. CENTCOM officials stated that logistics personnel could not always rely on radio frequency identification device technology to account for shipments. Despite a CENTCOM requirement that radio frequency identification device tags be used for all shipments to theater, CENTCOM estimated initial use was only about 30 percent. Among other problems experienced were the failure to attach tags to all containers and a lack of sufficient tracking devices to read tags in order to identify subsistence items stored in containers. As a result, logistics personnel stated they had to manually review all packing documents to identify the contents of containers, thereby slowing down the distribution of supplies.

Because of poor tracking, sufficient supplies of MREs sometimes existed but were not visible. For example, during the MRE shortage, a DOD official found over 17 20-foot containers with MREs at a supply base located halfway to Baghdad; the MREs were there for a week because no one knew they were there.

Efforts to Improve Availability

Short-term Efforts

To reduce MRE consumption during the shortage, Army and Marine Corps officials stated that units switched to alternate feeding methods such as Unitized Group Rations. CENTCOM reported working with various carriers and the (Military) Surface Deployment and Distribution Command⁴ to use sustainment packages weeks ahead of their scheduled issue dates.

To improve the distribution of MREs, military officials formed a joint working group including members from DLA, the Coalition Forces Land Component Command, CENTCOM, and U.S. Transportation Command.

⁴This command, formerly known at the Military Traffic Management Command, provides global surface deployment command and control and distribution operations.

This group communicates regularly to improve in-transit visibility over rations. CENTCOM officials stated that due to the lateness of ships arriving in theater, DLA located additional rations in other theaters that were shipped to OIF.

Long-term Efforts

To ensure timely visibility of anticipated requirements, DLA has recommended that collaboration between it, the Combatant Commands, and the services be enhanced. To improve the timeliness of funding, DLA is working with the services to refine their plans for releasing funding early in the deployment process. To deal with distribution problems in theater, the Secretary of Defense in September 2003 designated the U.S. Transportation Command as the Distribution Process Owner. The Transportation Command established a Deployment and Distribution Operations Center in January 2004. The center is responsible for improving the distribution process within theater by directing airport, seaport, and land transportation operations.

Five-Ton Truck and High-Mobility Multi-Purpose Wheeled Vehicle Tires

Background

The U.S. Army depends on a variety of trucks and other vehicles to support combat operations. During OIF, it relied on the 5-ton capacity cargo truck to transport all types of supplies and on the HMMWV to carry troops and armaments, as well as to serve as an ambulance and scout vehicle. The 5-ton truck (fig. 21) is outfitted with six radial tires and the HMMWV with four radial tires. The tires are specific to each type of vehicle and are not interchangeable.

Figure 21: M-923 5-ton Truck



Source: DOD.

The Army's TACOM Tire Group manages the tire inventory for wheeled vehicles, including the 5-ton truck and the HMMWV, for U.S. forces worldwide. These tires are produced for the military by several manufacturers, including Goodyear and Michelin.

Extent and Impact of Shortages

Tires for the 5-ton truck and the HMMWV were not available to the warfighter at some time between October 2002 and September 2004. We consider this item to have a shortage because demand exceeded the amount of inventory available to meet the needs of the warfighters. U.S. forces and logistics personnel reported critical shortages of 5-ton truck and HMMWV tires during OIF that negatively impacted their mission. According to TACOM officials, the increased pace of the operations

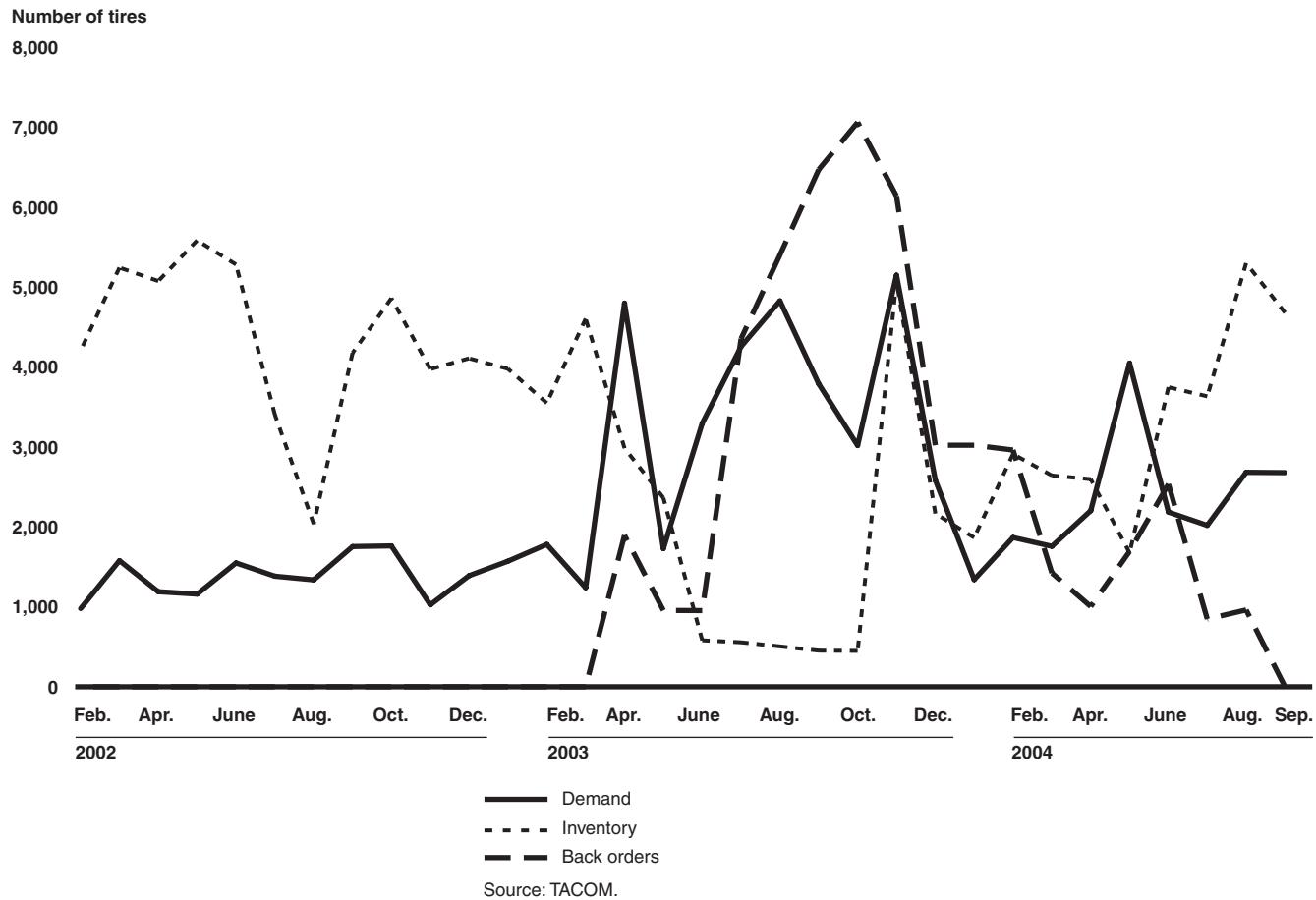
resulted in high-vehicle mileage that caused significant wear and tear on these tires.

Prior to the onset of OIF in March 2003, TACOM had no back orders for 5-ton truck tires and reported it was able to support demands from customers worldwide. However, as figure 22 shows, back orders started to accumulate after OIF began and, by October 2003, the number had peaked at 7,063 tires per month. Similarly, worldwide demand for tires rose after March 2003. As figure 22 indicates, this demand increased fourfold over the course of 1 year, climbing from a peacetime level of 1,189 tires in April 2002 to a wartime level of 4,800 tires in April 2003. While demand remained high during the summer of 2003, inventory levels dropped to below 1,000 and were insufficient to meet customer needs. For example, in August 2003 when demand reached 4,828 tires, TACOM recorded only 505 tires in its inventory worldwide.¹ According to TACOM officials, demands from OIF received priority and much of the available inventory supported operations in Iraq.

¹ Inventory as depicted in figure 22 does not include war reserve stock. As of October 2004, there were 2 5-ton truck tires in war reserves.

Appendix IX
Five-Ton Truck and High-Mobility
Multi-Purpose Wheeled Vehicle Tires

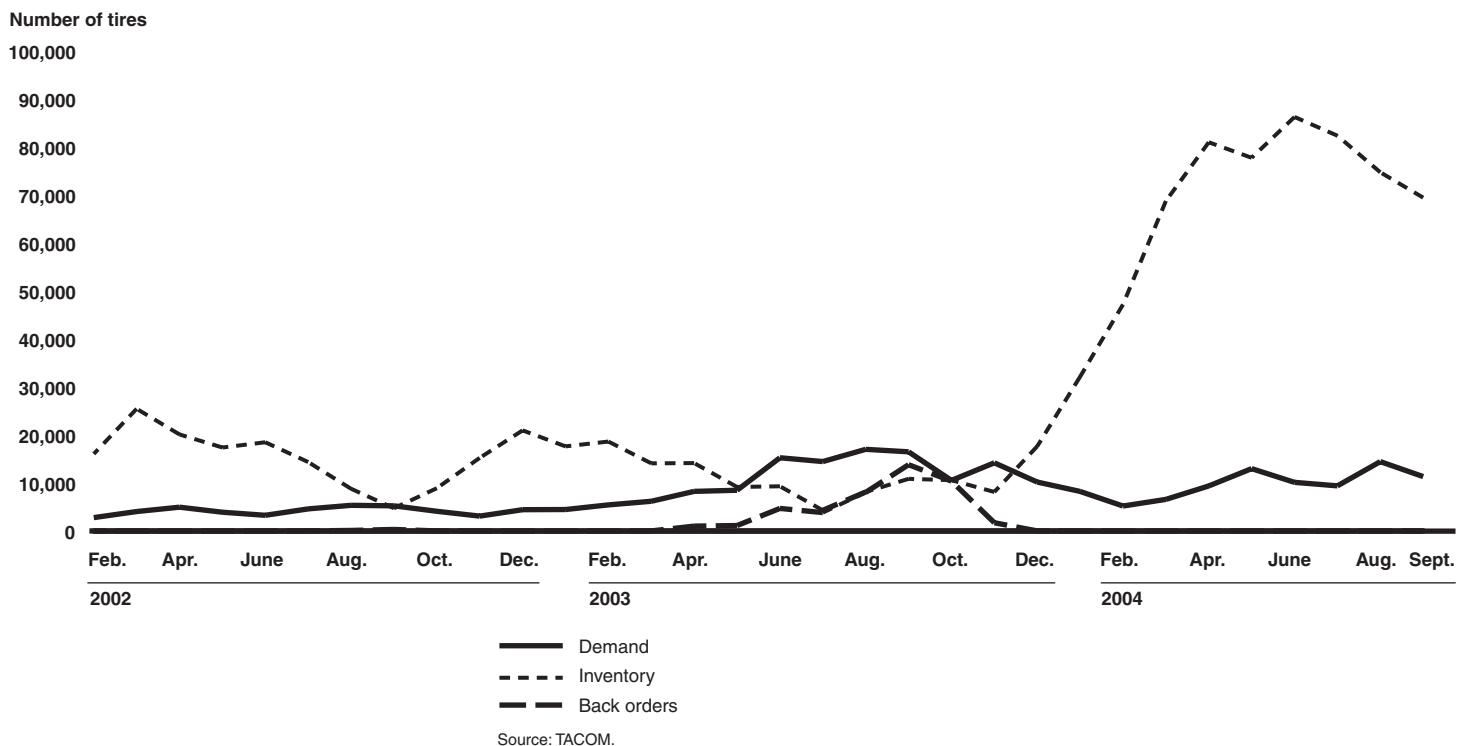
Figure 22: Worldwide Demand, Back Orders, and Inventory Level for the 5-ton Truck Tire by Month (February 2002 through September 2004)



TACOM reported no back orders for HMMWV tires prior to OIF. However, as figure 23 shows, back orders began to increase in April 2003 and peaked at 13,778 tires in September 2003 as demand increased and industry took several months to respond. According to TACOM officials, back orders accumulated because of the increasing demands coming from OIF. Worldwide demand rose rapidly in June 2003, peaked at 16,977 tires in August 2003, and gradually declined during the winter months (see fig. 23). Over the span of 1 year, worldwide demand increased more than four-fold, from a peacetime rate of 3,251 tires per month in June 2002 to 15,224 tires per month in June 2003. While demand grew during the summer of 2003, inventory levels were insufficient to meet customer needs. For example, in

July 2003, TACOM recorded only 4,286 HMMWV tires in its inventory, but had demands for a total of 14,435 tires. Fluctuating demands were caused by the intensity of the war fight and the changing mixture of weapons systems employed.

Figure 23: Worldwide Demand, Back Orders, and Inventory Level for the HMMWV Tire by Month (February 2002 through September 2004)



Army and Marine Corps units reported that tire shortages negatively affected operations in Iraq.² Units of the 3rd Infantry Division reported that they could not get the required number of tires to support their mission and that the shortage of tires forced them to leave vehicles and supplies behind. In addition, TACOM reported in June 2003 that it could only provide 64 percent of the spare parts, including tires that the 4th Infantry Division

² Units in Iraq reported shortages of tires in general, and not solely the 5-ton or the HMMWV radial tires.

considered urgent. Although the 4th Infantry Division reported shortages in theater, it did not report any mission impact due to tire shortages. In an after-action report, the U.S. Marine Corps documented that cannibalization, stripping, and abandoning otherwise good vehicles occurred because of the lack of spare tires.

Causes of Shortages

Problems with war reserve stocks, forecasted requirements planning, funding, and distribution contributed to shortages of the 5-ton and HMMWV radial tires during OIF.

Insufficient War Reserves Stock

The number of tires in war reserve stocks was not sufficient to support customer demands when OIF began. According to Army regulations, war reserve stocks are intended to meet the initial increase in demand during wartime and to fill the gap until the national supply system can increase production. In December 2002, TACOM officials managing war reserves established a requirement for 259 tires for 5-ton trucks. However, officials had only 38 tires on hand at that time, and 3 months later in March 2003, they had only 16 tires on hand. As of October 2004, the war reserve requirement for the 5-ton truck tire remained at 259 tires, but there were only 2 tires in the inventory. As figure 22 shows, the demand for 5-ton truck tires was always higher than 259 tires, starting with 978 tires in February 2002 and continuing throughout OIF. Therefore, the war reserve requirement of 259 tires was too low to support initial demands from units in theater.

For HMMWV radial tires, TACOM managers had a sufficient number of tires to meet the war reserve requirement of 1,505 tires in December 2002. In March 2003, managers increased the HMMWV tire war reserve requirement to 7,908 tires, but they failed to adequately stock tires in the inventory. At that time, they only had 1,483 tires on hand. As of October 2004, the war reserve requirement for HMMWV tires remained at 7,908 tires, but there were only 3,764 tires in the inventory.

TACOM officials told us that they do not adequately stock tires in the war reserves because they lack the necessary funding. This was the result of risk based decisions about how to allocate DOD funds. As of October 2004, TACOM's war reserve requirements for all items it manages (including tires) totaled \$1,355.7 million. However, it has received only \$828.9 million to support those requirements. As a result, TACOM officials have used a risk management approach to prioritize the funding of their

requirements. For example, they gave funding priority to more expensive items, such as tank engines, which have long lead-times and are difficult to procure, rather than to less expensive items, such as tires, which can be produced faster. When OIF began, tires stocked in war reserves were inadequate to support initial customer demands because of these decisions.

Inaccurate Forecasted Requirements

TACOM's forecasted requirements for vehicle tires underestimated the actual demand for tires during fiscal year 2003. For example, TACOM forecasted that worldwide requirements,³ for the 5-ton truck tire would reach 1,497 tires per month in April 2003; however, the actual demand for this tire rose to 4,800 for that month, more than three times higher than the forecasted requirements. Similarly, TACOM forecasted that customers would need 5,800 HMMWV tires per month in June 2003; instead, actual worldwide demand for HMMWV tires grew to 15,224 per month, three times higher than the forecasted amount.

In June 2003, TACOM changed its requirements forecasting model for tires and other spare parts from a 12-month average demand base to a 30-day average demand base to respond to the sharp increase in actual demand. According to TACOM officials, the 12-month average demand base model did not react quickly enough to actual demands, which were at times three or four times higher than the monthly forecasted requirements. By changing the model to a 30-day average demand base, TACOM was able to stock up on inventory faster.

In setting forecasted requirements for tires, TACOM officials stated they relied heavily on past historical demand data because it received little guidance on the expected demand activities or operational plans from Army headquarters. TACOM expected an increase in demand for fiscal year 2003 because of the growing demand from southwest Asia, especially Kuwait, prior to the onset of OIF. Officials from TACOM's Tire Group told us they put an emphasis on past historical demand data to forecast their future requirements. Similarly, TACOM's Track and Roadwheel Group reported that they relied on historical data, including information from Operation Desert Storm/Shield and operations in Bosnia, to help them forecast future requirements in the absence of official guidance.

³ TACOM's worldwide forecasted requirements included those for OIF. According to TACOM officials, much of the worldwide demand was driven by demand from OIF.

Insufficient and Erratic Funding

According to TACOM officials, the Tire Group did not receive adequate funding (referred to as obligation authority) from the Department of the Army's working capital fund to buy additional tires to meet customers' needs. Furthermore, when obligation authority became available, they did not receive it promptly. In fiscal year 2003, TACOM had worldwide demands for tires totaling \$246.3 million; however, it received only \$212 million in obligation authority, about 86 percent of its total requirements. By comparison, during the same fiscal year, TACOM received about \$118.5 million worth of requisitions for all tires needed in OIF. As TACOM exhausted its obligation authority during fiscal year 2003, additional releases came in sporadically. For example, in July 2003, TACOM reported that it had used all of its obligation authority but still had \$22 million worth of contracts that needed funding; by August 2003, however, TACOM reported that it had funds available to continue awarding contracts.⁴ TACOM's Tire Group complained that the 'stop-start' funding releases complicated their efforts in maintaining a consistent supply of tires from tire manufacturers by preventing them from providing a steady stream of funds in advance of production lead-time.

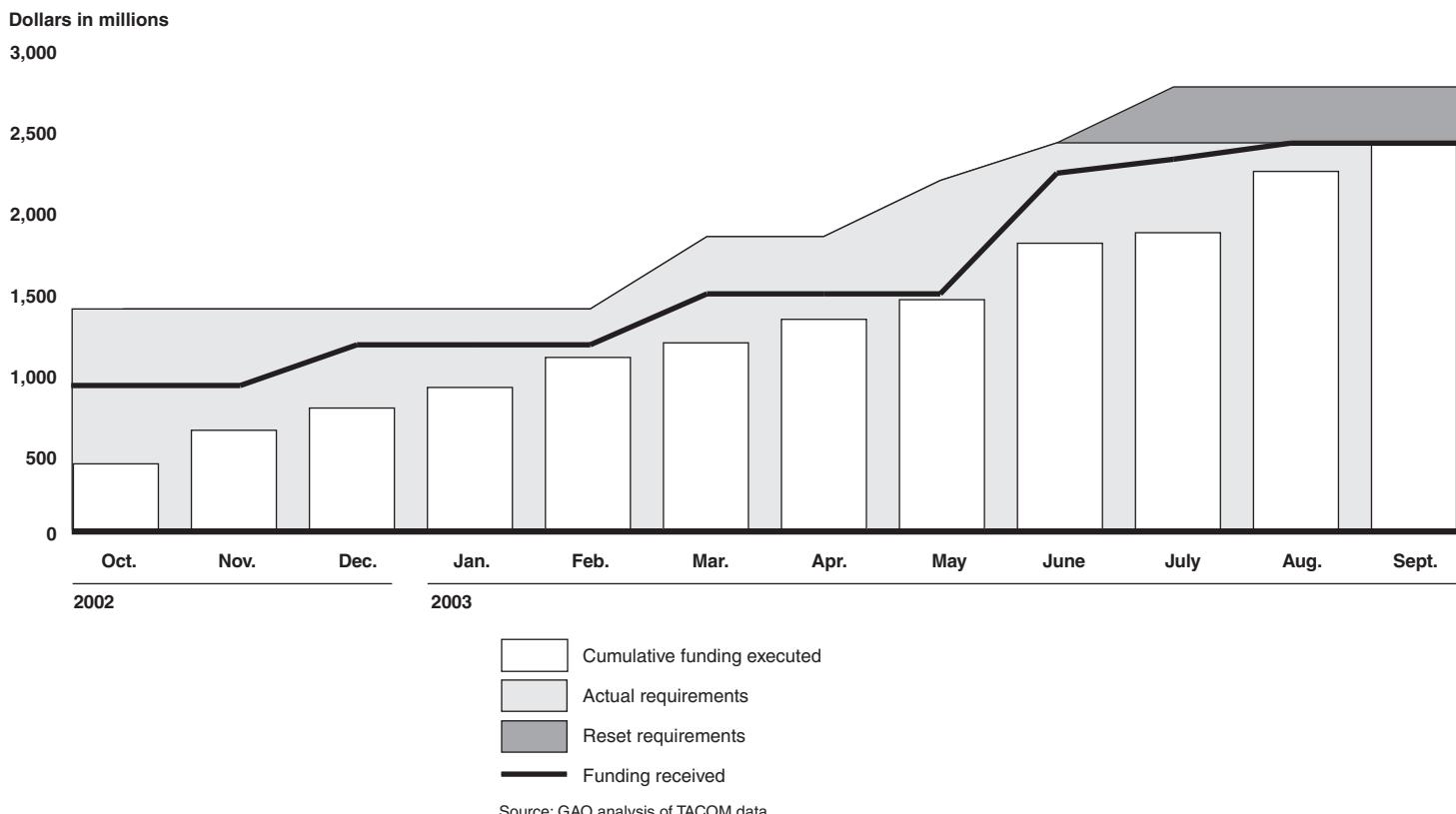
TACOM's Tire Group also did not know when or how much the next release of obligation authority would be. In order to ensure that the industrial base could provide supplies promptly, TACOM needed funding at least one procurement lead-time (e.g., the time it takes a manufacturer to make and deliver the tire) in advance of the delivery date. For most tires, the procurement lead-time is 3 to 6 months. Therefore, in order to meet unexpected surges in demand, TACOM needed to have funding available 3 to 6 months prior to the surge.

In addition to the Tire Group, TACOM as a whole was underfunded in fiscal year 2003. Figure 24 shows that throughout fiscal year 2003, TACOM was funded below its actual requirements. At the beginning of fiscal year 2003, TACOM identified its requirements at \$1,357 million; however, it was provided with only \$885 million in obligation authority. By May 2003, TACOM came close to using all of its obligated authority without any assurance that additional funding would arrive. As a result, TACOM officials asked their support groups to conserve funding for the most critical items until additional funding arrived. However, in June 2003

⁴ The primary long-term contract was with Goodyear while Michelin provided some additional tires.

TACOM received additional funding, which allowed item managers to resume awarding contracts for supplies. For fiscal year 2003, TACOM identified its actual requirements at \$2,726 million (including \$345 million for reset)⁵ but it received only \$2,379 million in obligation authority.

Figure 24: TACOM's Actual and Reset Requirements, Funding Executed and Received by Month, Fiscal Year 2003



⁵ Reset is a term used to define bringing a vehicle that was used during Operation Enduring Freedom and OIF back to a fully mission-capable (serviceable) condition so that units can be combat-ready for other deployments. Resetting a vehicle involves extensive use of spare parts to bring the vehicles up to a fully mission-capable condition.

Constraints in the Distribution Process

Distribution constraints, both in the continental U.S. and in OIF, contributed to customers not receiving supplies. The distribution system was not prepared to handle the volume of supplies ordered by customers or the speed with which supplies needed to be delivered.

In the summer of 2003, the Defense Distribution Center Susquehanna, Pennsylvania, became overwhelmed by the volume of incoming shipments from contractors delivering supplies for units in Iraq. Because of the increased volume, the center gave contractors delivery appointment times that were 2 to 3 weeks in the future, thereby delaying the delivery and processing of many items, including tires.

Once tires were in the distribution center's warehouse, the requirement to build pallets to ship them to the theater caused further delays. Officials told us that the backlog of pallet building resulted in delays of up to 30 days or more before tire shipments could be released from the center. To alleviate this backlog, all tires shipped in and after June 2003 were diverted to the Defense Depot Red River, Texas, to be palletized and shipped directly to aerial ports of embarkations at Charleston and Dover Air Force Base.

Once tires were shipped from the U.S., TACOM lost all visibility of tire shipments within CENTCOM's area of responsibility. At the Port of Kuwait, containers could not be identified because radio frequency identification tags that should have been on the pallets were lost during shipment, thus increasing processing time. In addition, once these shipments left the port, receipts were not posted at the customer supply support center to verify delivery. Officials also stated that because of the lack of in-transit visibility, shipments were frequently diverted to other destinations without TACOM's knowledge or authorization.

Efforts to Improve Availability

TACOM initiated several temporary actions and one long-term action to improve the availability of tires to customers in the field. However, TACOM officials did not identify efforts to improve funding problems experienced during OIF, and they told us that they are not aware of any initiatives at AMC headquarters or the Department of the Army that address funding issues.

Short-term Efforts

To ensure that forecasted requirements better reflected actual demands, in June 2003, TACOM's Tire Group changed the average demand base it used to calculate requirements from 12 months to 30 days. By making this change, the Tire Group captured demand data in real-time and allowed item managers to better estimate future requirements. As a result, item managers were able to justify procuring more tires to meet future demands.

To ensure continuous production while awaiting additional obligation authority, officials from TACOM's Tire Group noted persuading manufacturers to continue making tires. Tire manufacturers continued making tires while waiting for contracts and made capital investments to procure more tire molds, enabling them to increase production once contracts were awarded and obligation authority became available.

To ensure quicker distribution of tires to customers in theater, TACOM sent a group of supply personnel to Camp Arifjan in Kuwait to expedite the processing of TACOM's shipments of tires and other spare parts. In response to complaints that TACOM's tire and spare parts shipments were being diverted and not reaching the right customers, TACOM's supply personnel also helped to look for these shipments and get them delivered.

Long-term Efforts

To help solve the long-term distribution problems in theater, in September 2003 the Secretary of Defense designated the U.S. Transportation Command (TRANSCOM) as DOD's Distribution Process Owner. TRANSCOM established a Deployment and Distribution Operation Center in January 2004. Under the control of CENTCOM, this center is responsible for improving the distribution process within theater by directing all airport, seaport, and land transportation operations.

Up-Armored High-Mobility Multi-Purpose Wheeled Vehicle and Add-on-Armor Kit

Background

The HMMWV is a highly mobile, diesel-powered, four-wheel-drive vehicle with a 4,400 pound payload. Using common components and kits, the HMMWV can be configured to become a troop carrier, armament carrier, shelter carrier, ambulance, anti-tank missile carrier, or scout vehicle. The initial number and type of HMMWVs in each unit is based on standard equipment lists. According to officials, they are the most numerous U.S. military vehicles in CENTCOM's area of responsibility. The Army reported that there were 18,656 vehicles—both armored and unarmored—in theater, as of July 2004.¹

Up-Armored HMMWV

One version of the HMMWV is a production model known as an Up-Armored HMMWV, also designated as the M1114 model (see fig. 25). This model is produced by AM General Corporation and armored by O'Gara-Hess Eisenhardt, requirements for CENTCOM's area of operations, including Iraq and Afghanistan, call for this up-armored variant. The M1114 model of the vehicle features ballistic-resistant windows and steel-plate armor on the doors and underside to protect against rifle rounds and explosive blasts, fragmentation protection, and additional armor for the turret gunner on the roof to protect against artillery, as well as a powerful air conditioning system.

¹ The U.S. Army recognizes three levels of armor protection for HMMWVs in Iraq. Level 1 is the Up-armored HMMWV, level 2 is a HMMWV with an add-on-armor kit, and level 3 is field-improvised armor.

Figure 25: Up-Armored HMMWV



Source: DOD.

Add-on-Armor Kits

In order to provide armor protection to existing unarmored HMMWVs in theater, the Army has developed an add-on-armor kit to be mounted on vehicles. The basic kit includes armored doors, under-door armor plates, seat-back armor, ballistic glass windows, and a heavy-duty air conditioning system. Seven Army depots and arsenals, managed by the Ground Systems Industrial Enterprise,² currently produce the kits. The Army began shipping the kits to Iraq by mid-November 2003 and started mass production at their depots in December 2003. The Army also contracted with O'Gara Hess Eisenhardt to produce additional armor kits to meet theater requirements.

² Ground System Industrial Enterprise is a TACOM organization responsible for managing TACOM's arsenals and depots.

Figure 26: Add-on-Armor Kit Mounted on HMMWV



Source: DOD.

Requirements for up-armored HMMWVs and add-on-armor kits are identified through operational needs statements directly from the theater that are validated and resourced by the Army. Units in theater submit the statements for the items, which are combined by their higher headquarters into bulk Coalition requirements. The Coalition Forces Land Component Command communicates these requirements for vehicles and kits to the Department of the Army, where they are validated and resourced by the Army's Deputy Chiefs of Staff and eventually transmitted to the Program Executive Office—Combat Service and Combat Service Support Tactical Vehicles, who manages the procurement of both the up-armored HMMWVs and the add-on-armor kits.

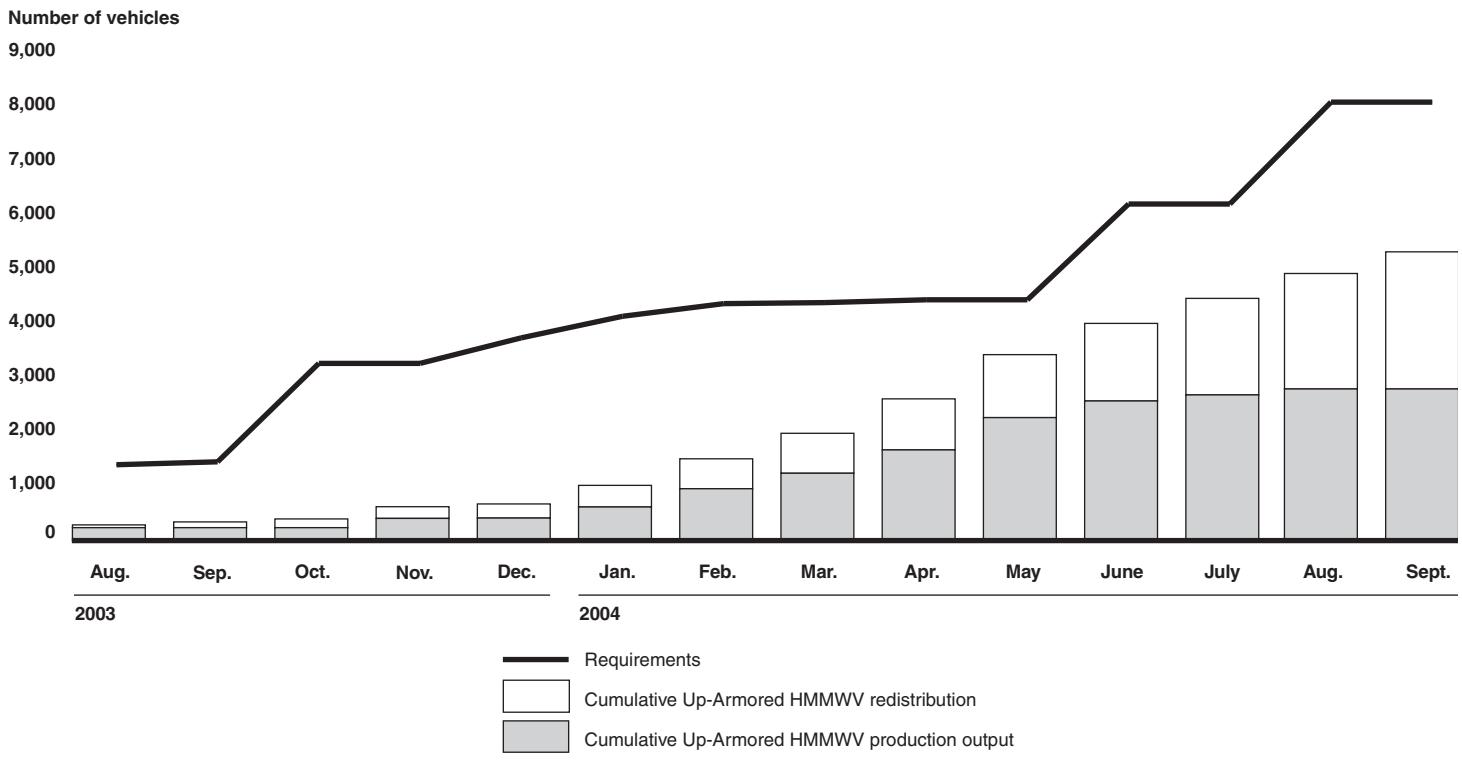
Extent and Impact of Shortages

Up-armored HMMWVs and add-on-armor kits were not available to the warfighter at some time between October 2002 and September 2004. We consider this item to have a shortage because vehicles and kits were not available to meet the validated requirements developed by the warfighters. The Army has been consistently unable to meet recurring spikes in demand for vehicles and kits. However, the overall impact of the Army's inability to deliver the vehicles and kits is difficult to measure.

**Extent of Up-Armored
HMMWV Shortages**

Since the Coalition Forces Land Component Command first began identifying up-armored HMMWV requirements for CENTCOM's area of responsibility in the summer of 2003, there has been a gap between the number of vehicles required and the number of vehicles the industrial base is producing. By September 2004, TACOM and the Army had provided 5,330 of the 8,105 required vehicles in theater. To meet Coalition Forces Land Component Command's requirements, the Army program managers worked with O'Gara-Hess Eisenhardt to produce an additional 2,533 new up-armored HMMWVs and the Department of the Army redistributed an additional 2,797 existing vehicles to Iraq from elsewhere in the world. Figure 27 shows that Coalition Forces Land Component Command requirements for vehicles increased faster than O'Gara-Hess Eisenhardt was producing them, with requirements growing from 1,407 vehicles in August 2003 to 8,105 vehicles by September 2004. The Army worked with the manufacturers to increase production from 51 vehicles per month in August 2003 to 400 vehicles per month in September 2004. According to Army officials, O'Gara-Hess Eisenhardt will increase production to its maximum capacity of 550 vehicles per month and will meet current requirements by March 2005.

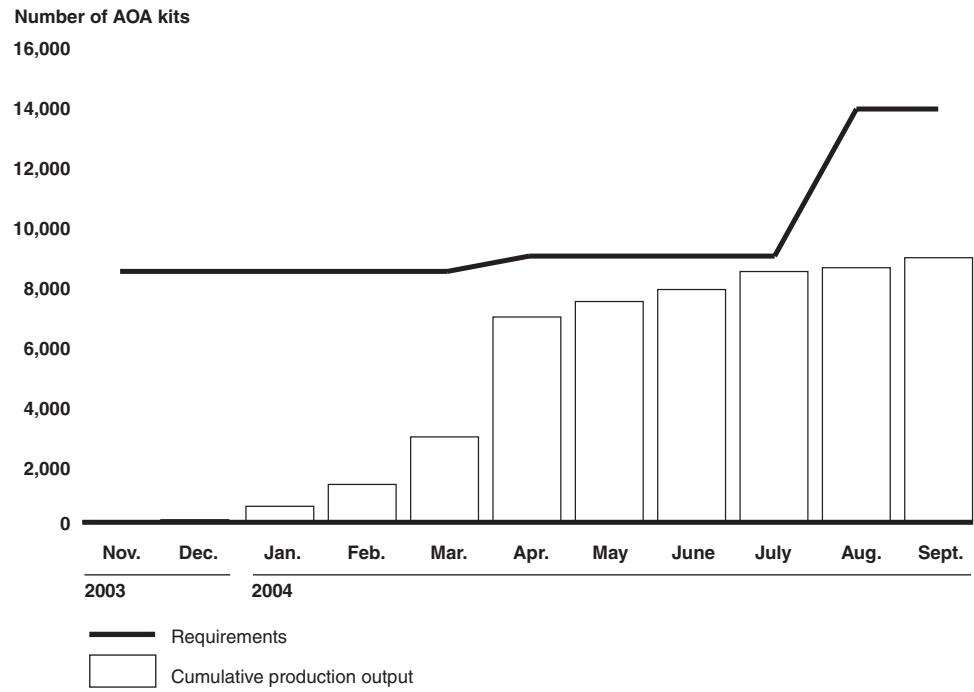
Figure 27: Up-Armored HMMWV Requirements, Production Output, and Redistribution from August 2003 through September 2004



Extent of Add-on-Armor Kit Shortages

As of September 2004, the Army supplied 8,771 of the 13,872 Add-on Armor kits required by CENTCOM but still needed 5,101 additional kits to meet all requirements. The Ground Systems Industrial Enterprise depots and arsenals were required to produce 12,372 while O'Gara-Hess Eisenhardt was required to produce the remaining 1,500 kits. As shown in figure 28, by September 2004 the validated requirement of 8,400 kits grew to 13,872. To meet the 8,400 requirement, program managers worked with several Army depots to increase production from 35 kits a month in December 2003 to 600 kits per month by July 2004. At this production level, theater requirements would have been met by August 2004. However during this same month, Coalition Forces Land Component Command increased the requirement to 13,872 kits. Army officials stated that it would take 3 to 4 months to meet this new demand and accordingly expected the requirement to be met by early 2005.

Figure 28: Add-on-Armor Requirements and Production Output, November 2003 through September 2004



Source: GAO analysis of Army data.

The overall impact of up-armored vehicle and add-on-armor kit shortages is difficult to measure because units do not report the direct effects of using unarmored HMMWVs, but the reason for increasing requirements is well documented. Current HMMWVs are protected only by canvas tops and have no additional armor protection. According to the Center for Army Lessons Learned, the harm to both personnel and equipment from improvised explosive devices is greatly reduced when traveling in an up-armored HMMWV.³ This has generated a theater-wide concern for increased vehicle protection. While units have used field-improvised steel enclosures and other modifications to increase vehicle protection, up-armored vehicles and add-on-armor kits provide better protection. The center specifically mentions that the up-armored HMMWVs would improve the force protection of civil affairs teams as well as provide ideal

³ Center for Army Lessons Learned, *Initial Impressions Report, Operation Iraqi Freedom*, May 2004.

transport for teams of engineers operating in the constricted urban environments of Iraq.

Causes of Shortages

Production Was Not Paced to Match Maximum Capacity

There are two primary causes for the shortages of up-armored vehicles and add-on-armor kits. First, a decision was made to pace production rather than use the maximum available capacity. Second, funding allocations did not keep up with rapidly increasing requirements.

DOD paced the production of armor for HMMWVs to meet initial CENTCOM requirements, but did not use the maximum available production capacity as the requirements increased dramatically after the onset of OIF. According to Army officials, the total Army up-armored HMMWV requirement prior to OIF was approximately 360 vehicles per year, to be produced at a rate of 30 vehicles per month. However, beginning in August 2003, Coalition Forces Land Component Command developed new requirements for additional up-armored HMMWVs based on requests from units in theater; the requirement increased 576 percent from 1,407 to 8,105 vehicles by September 2004. There was also a significant increase in the requirement for kits. In November 2003, the initial requirement for Add-on Armor kits was 8,400 kits. By September 2004, the requirement had increased to 13,872 kits.

O’Gara-Hess Eisenhardt, the sole producer of the up-armored HMMWV, increased production, in accordance with agreements with the Army; however, that rate of production has not been sufficient to meet increasing demands. The schedule of monthly production increases agreed to by the Army and O’Gara-Hess Eisenhardt was based on meeting existing requirements established at a particular time as well as funding constraints. For example, the Army had requirements of 4,149 vehicles in February 2004 to meet CENTCOM’s needs. In meeting this requirement, the Army redistributed over 3,000 existing up-armored HMMWVs to CENTCOM’s area of responsibility and agreed to have O’Gara-Hess Eisenhardt to produce the rest of the vehicles. The Army had planned to meet the February 2004 requirement by July 2004 without having O’Gara-Hess Eisenhardt reach its maximum capacity.

As shown in figure 27, the vehicle production rate has increased every month from 51 vehicles in August 2003 to 400 vehicles by September 2004, with a planned production of 460 vehicles per month by October 2004.

However, the signed agreement with O'Gara-Hess Eisenhardt indicates that the maximum production could have been increased to 500 vehicles per month in October 2004 if needed. Interviews with Army and contractor personnel indicated that there were other constraints on production, such as the availability of communication equipment.

Despite increasing requirements for the add-on-armor kits, additional available production capacity was not used. Prior to CENTCOM's requirement for 8,400 kits in November 2003, the Army had already begun designing and shipping some 'pilot' kits in theater. When it received the requirements in 2003 for 8,400 kits, the Ground Systems Industrial Enterprise's depots and arsenals began ordering raw materiel such as steel and ballistic glass and ramped up production from 35 kits per month in December 2003 to 3,998 kits per month in April 2004. As total production neared the 2003 requirement, production was slowed to 333 per month by September 2004. Because the kits take three to four months to produce, it was not until January 2004 that the depots and arsenals began shipping substantial quantities to theater.

Our review of Army data and interviews with Army officials shows that additional capacity to produce kits was available within the Ground Systems Industrial Enterprise system. Managers at Ground Systems Industrial Enterprise indicated that seven arsenals and depots could have maintained the maximum level of production without affecting other operations at the depot, filling the kit requirement early in 2004. In addition, in February 2004, a contractor operated Army facility informed the Ground Systems Industrial Enterprise managers that it could produce another 800 4-door kits per month. While the managers stated that they did not use the contract operated facility due to issues with contract timing and price, they did not have information on the decision to slow the pace of production.

DOD decision makers determined the pace at which both up-armored HMMWVs and kits would be produced, but did not inform Congress about the total available production capacity. We have not been able to determine what criteria were used to set the pace of production; however, in both cases, additional production capacity was available, particularly for the kits. As a result of the lack of visibility into and acceptance of decisions made about the rate of production, DOD received criticism about the availability of armored vehicles in Iraq.

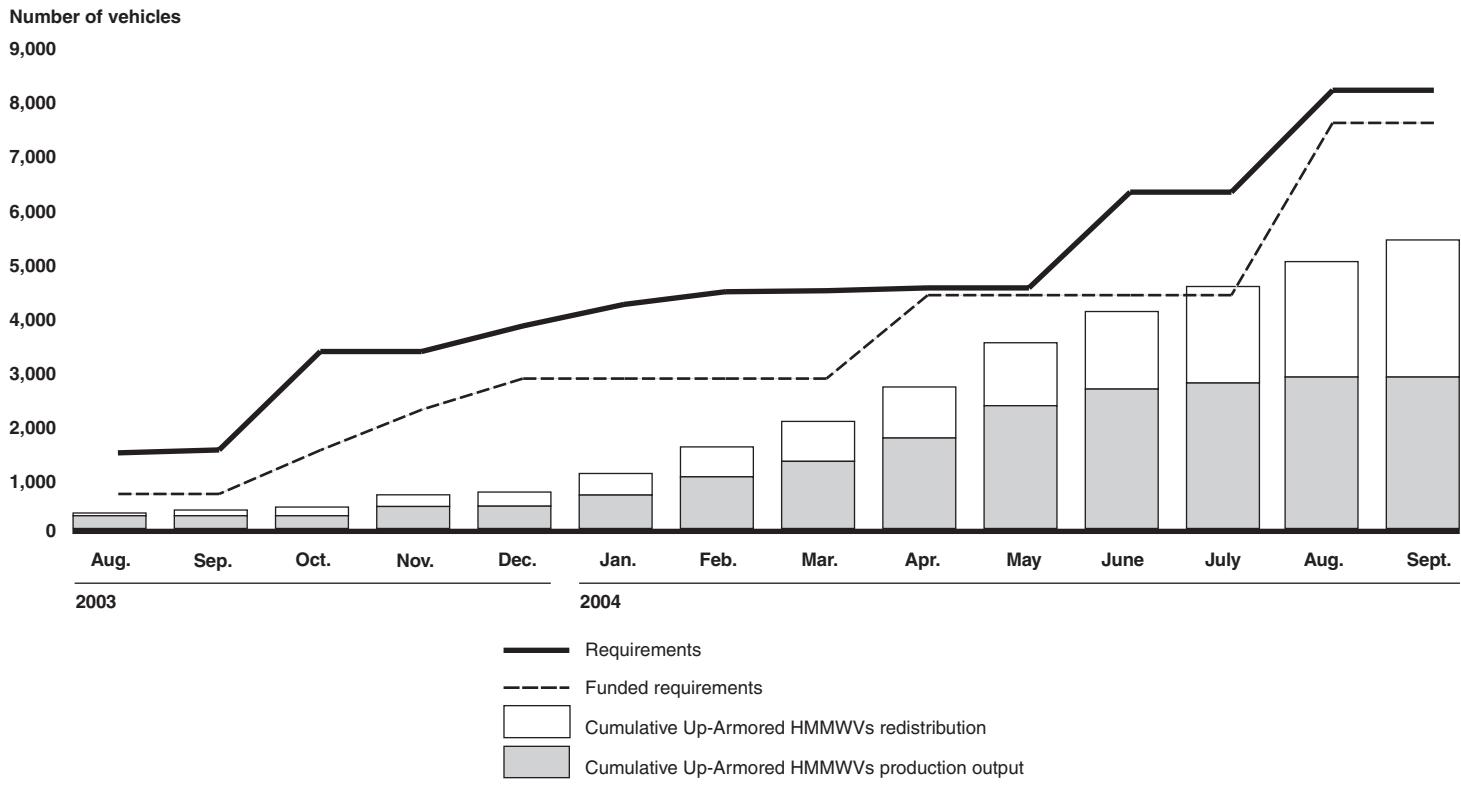
**Funding for Up-Armored
HMMWV Production Was
Not Received in a Timely or
Predictable Manner**

While funds were available to support the planned pace of production of up-armored HMMWVs,⁴ program managers were not aware of the time frame for releasing funds. Although TACOM received over \$1.4 billion between fiscal years 2003 and 2004 to produce 7,502 vehicles, it was not released in a timely and predictable manner. Figure 29 shows that in August 2003, the managers received requirements for 1,407 vehicles. However, it had received funding to produce only 648 vehicles. By October 2003, program managers had a requirement to produce 3,279 vehicles, but received funding to produce only 1,456 vehicles. Significant differences continued until April 2004, when requirements reached 4,454 vehicles and the program managers received funding to produce 4,320 vehicles.

⁴ Neither AM General nor O'Gara-Hess Eisenhardt reported that the Army was not able to pay them for the vehicles they produced.

Appendix X
Up-Armored High-Mobility Multi-Purpose
Wheeled Vehicle and Add-on-Armor Kit

Figure 29: Up-Armored HMMWV Funding, Requirements, Production Output by Month (August 2003 through September 2004)



The disbursement of funds affected program managers' ability to plan and contract with O'Gara-Hess Eisenhardt to produce sufficient quantities of up-armored HMMWVs. As shown in figure 29, requirements increased in June 2004 to 6,223 vehicles and again in August to 8,105 vehicles. However, additional funding—\$572 million—was not received until August 25, 2004 to meet demands. As a result, Army officials stated it could not ask O'Gara-Hess Eisenhardt to ramp up to its maximum capacity of 550 vehicles per month because it did not have the funding at the time requirements increased. Furthermore, program managers explained that if O'Gara-Hess Eisenhardt is to efficiently produce vehicles at a consistent and high rate, the company should be assured of consistent funding at least 3 months in advance of delivery. The program officials stated that they did not know when funding would come, how many disbursements they would be receiving in a given fiscal year, or what amount of funding to expect, thus further complicating their procurement planning.

Efforts to Improve Availability

Short-term Efforts

The major short-term solution to the up-armored HMMWV funding issue has been the receipt of additional funding from congressional increases, supplemental funding, and Office of Secretary of Defense additions. For fiscal years 2003 and 2004, the Army received over \$1.4 billion to produce 7,502 up-armored HMMWVs to meet worldwide requirements, including 8,105 vehicles required for CENTCOM's area of operation, mostly from congressional increases and supplementals. Specifically in fiscal year 2004, the Army received \$1.19 billion in congressional plus-ups, supplementals, and Office of Secretary of Defense additions above its \$51.7 million received in the President's Budget to produce more up-armored HMMWVs.

To meet continuing needs for force protection, Congress recommended \$865 million in the 2005 appropriations bill to be used by the Army to armor additional HMMWVs and other vehicles. As part of the Rapid Response Force Protection Initiative, Congress intends the funds to be used to purchase and modify a variety of vehicles currently used in theater to respond rapidly to the threat of improvised explosive devices and mortar attacks experienced by deployed U.S. forces.

To improve the industrial capability, the Army worked with O'Gara-Hess Eisenhardt as well as Army depots to increase production of vehicles and kits. For example, program managers worked with O'Gara-Hess Eisenhardt to increase up-armored HMMWV production from an average of 30 vehicles a month to 400 vehicles a month by September 2004. The company plans to increase production to a maximum 550 vehicles a month to meet current requirements by March 2005. Army also ran 24-hour assembly lines at its depots and produced over 1,000 add-on-armor kits per week between March and April 2004 when materials were available to make the kits.

Long-term Efforts

At the time of this review, Army officials had not identified any long-term efforts to improve the availability of up-armored HMMWVs or add-on-armor kits.

Comments from the Department of Defense

Note: GAO's comments supplementing those in the report's text appear at the end of this appendix.



DEPUTY UNDER SECRETARY OF DEFENSE FOR
LOGISTICS AND MATERIEL READINESS
3500 DEFENSE PENTAGON
WASHINGTON, DC 20301-3500

MAR 23 2005

Mr. William Solis
Director, Defense Capabilities and Management
U.S. Government Accountability Office
Washington, DC 20548

Dear Mr. Solis:

This is the Department of Defense (DoD) response to the GAO draft GAO-05-275, DEFENSE INVENTORY: Actions Needed to Improve the Availability of Critical Items During Current and Future Operations, dated February 18, 2005 (GAO Code 350492). The GAO draft report highlights five deficiencies that caused shortages of spare parts and supplies to U.S. Forces in Iraq between October 2003 and September 2004 on seven of nine items reviewed. The DoD concurs with the intent of the recommendations in the report and has already taken actions as needed to eliminate deficiencies.

Detailed comments on the draft report recommendations are included in the enclosure. The DoD appreciates the opportunity to comment on the draft report.



Bradley Berkson
Acting

Enclosure:
As stated



GAO-05-275/GAO CODE 350492
“DEFENSE INVENTORY: ACTIONS NEEDED TO IMPROVE
THE AVAILABILITY OF CRITICAL ITEMS DURING
CURRENT AND FUTURE OPERATIONS”

DEPARTMENT OF DEFENSE COMMENTS
TO THE RECOMMENDATIONS

RECOMMENDATION 1: The GAO recommended that the Secretary of Defense direct the Secretary of the Army to improve the accuracy of Army war reserve requirements and transparency about their adequacy by:

- updating the war reserve models with OIF consumption data that validate the type and number of items needed,
- modeling war reserve requirements at least annually to update the war reserve estimates based on changing operational and equipment requirements, and
- disclosing to Congress the impact on military operations of its risk management decision about the percentage of war reserves being funded.

(Pages 52-53/Draft Report)

DoD RESPONSE: Concur with intent. The Army recognizes the need to improve the accuracy of its war reserve requirements, update those requirements annually, and appropriately disclose unfunded requirements and has already taken action to do so.

Army actions are as follows:

a. Army War Reserves (WR) are computed based on specific scenarios associated with areas where the outbreak of contingencies is potentially high based on the Strategic Planning Guidance. Thereafter, the Army Prepositioned Stocks/WR are strategically prepositioned in the proximity of those areas to enable rapid responses in the event contingencies occur. Prior to the commencement of the Global War on Terrorism (GWOT) and the start of Operations Enduring Freedom and Iraqi Freedom (OEF/OIF), the risk management decisions made by Army leadership on military operations were factors on how WR funding was allocated against an unknown future requirement in addition to the overall level of risk. The Army is taking steps to better compute WR requirements and to increase WR funding. These steps include:

- (1) Recently, the Army Materiel Systems Analysis Activity, teaming with RAND Corp., developed a methodology to capture OIF consumption data. This data will be used to

Note: Page numbers in the draft report may differ from those in this report.

See comment 1.

update the sparing model's candidate item spares population and predictive failure rates (failure factors) found within the Army WR Requirements Automated Process (AWRAP).

- (a) This revised candidate item and failure factor data will be used to develop the Army's Fiscal Year 2005 (FY 2005) WR Secondary Item (WRSI) requirements. The requirements development process is currently scheduled for completion in September 2005. The results will drive Army funding requirements in the next budget cycle.
- (b) WRSIs are critical consumable and reparable secondary items acquired in peacetime to sustain operations as prescribed by the Strategic Planning Guidance (SPG). This inventory provides the initial supply support for the Army's prepositioned brigade sets, medical sets, operational project stocks, and sustainment stocks for committed forces and must be stocked on the shelf to ensure that future requirements will be available to sustain a theater until resupply is established.

(2) The AWRAP, used to compute new WRSIs and generally conducted biennially to coincide with the building of the Program Objective Memorandum (POM), has been changed to an annual update to keep pace with dynamic Department of the Army (DA), Department of Defense (DoD), and Joint operational guidance.

See comment 2.

- (a) In January 2005, Army G-4 published the AWRS Secondary Items Computation Guidance which enables USAMC and United States Army Medical Materiel Agency to calculate new secondary items sustainment stock requirements based on the new warfighting scenarios. Updated consumption rates and planning factors from Force Structure Analysis (mini Total Army Analysis) were used to ensure that we will have an improved, responsive capability to compute WRSI requirements that are aligned with how the Army builds its force structure requirements.

See comment 3.

- (b) WRSIs will continue to play an important role in enabling the Army to meet both its current warfighting requirements and any future contingencies. However, without adequate funding, there is substantial risk to their availability. Risk associated with inadequate funding is already reported to Congress in various forums as required, including the budget process, testimony to hearings, and congressional inquiries.

RECOMMENDATION 2: The GAO recommended that the Secretary of Defense direct the Secretary of the Army to improve the accuracy of its wartime supply requirements forecasting process by:

- developing models that can compute operational supply requirements for deploying units more promptly as part of prewar planning, and
- providing item managers with operational information in a timely manner so they can adjust modeled wartime requirements as necessary.

(Page 53/Draft Report)

DoD RESPONSE: Concur with intent. The Army recognizes the need to improve the accuracy of its wartime supply requirements forecasting process and already has taken actions to do so.

On-going actions within the Army are as follows:

- a. Using preliminary logistics intelligence/information, Army weapon system managers made stockage level decisions, largely based on historical data gathered from the first conflict in the region, Operation Desert Storm (ODS). The empirical data gathered from ODS indicated that we could expect a threefold increase in the monthly demand rate for the majority of class IX items. The Requirements Determination & Execution System (RD&ES) defaults were set at that level to allow for forecasting the increased usage rate. The RD&ES system is a useful tool in forecasting anticipated Class IX usage rates, provided the correct feeder data is introduced into the system. The historical Class IX consumption data of ODS proved to underestimate requirements for the current operation. The lack of a dynamic forecasting system, capable of reacting quickly to unknown situations, clearly contributed to the Class IX shortage problems. For example during OIF, modeled forces and their equipment changed from wheeled to tracked several times over, thereby frustrating supply forecasts; earlier environment protection decisions warranted the stockage of rechargeable batteries instead of lithium batteries; additionally, operational decisions to place add-on-armor to all deployed wheeled vehicles increased vehicle wear and tear with the effect being an increase in the demand for CL IX repair parts.
- b. The USAMC did take steps to increase the forecasting accuracy – the demand forecast period was reduced from 24 months to 12 and even 6 months. Past demands were modified with Program Change Factors to reflect the astronomical growth. With all the shortcomings discussed in this report, logistics support to OIF did enjoy much success. Readiness rates for deployed equipment hover very close to the DA peacetime goal of 90 percent, even though deployed equipment has endured Operational Tempo (OPTEMPO) rates as much as 12 times higher than normal peacetime rates.
- c. Prior to the out break of OIF/OEF, the Army had developed the Deployment Stock Package Analyzer (DSPA) to use in conjunction with the RD&ES. This model uses the same candidate item spares data base as our WR model, but computes the change in demand patterns that could be expected from deployed units, offsets the requirement by the stocks on hand, and develops a strategic stockage level to support the expected surge. Army was in the process of refining algorithms, developing policy for item managers and using units, and obtaining funding when GWOT broke out. We were working to incorporate DSPA into the Commodity Command Standard System, our strategic level legacy system. In the meantime, we are moving into an Enterprise Resource Planning environment. The requirement to support deployment surges will be addressed in both our strategic and retail systems. The Logistics Modernization Program has been fielded to the Communications-Electronics Command and is undergoing design stabilization. Future fieldings are event driven with fielding to the Aviation and Missile Command tentatively scheduled for second quarter FY 2006 and the Tank-automotive and Armament Command first quarter FY 2007. The Global Combat Support System-Army is being blueprinted now. Fielding is scheduled to FY 2007- FY 2009.

See comment 4.

See comment 5.

See comment 6.

RECOMMENDATION 3: The GAO recommended that the Secretary of Defense direct the Secretary of the Army to reduce the time delay in granting increased obligation authority to the Army Material Command and its subordinate commands to support their forecasted wartime requirements by establishing an expeditious supply requirements validation process that provides accurate information to support timely and sufficient funding. (Page 53/Draft Report)

DoD RESPONSE: Concur with intent. We agree that supply requirements validation process to support timely and sufficient funding must be expeditious. However, with the value of required resources the validation process must also be justifiable.

Since the start of OEF/OIF, Army demand exceeded predictions. As a result, Army had a requirement for \$1.6 billion above their budgeted amount. Since this requirement was forwarded for funding in the year of execution, the Army Staff needed to ensure the validity of the underlying assumptions and requirements determination process. In order to provide additional Obligation Authority or Total Obligation Authority (cash infusion), Army had to forward and justify their request to the OSD Comptroller. It was absolutely necessary to scrub and validate the request for additional funds at a lower level to ensure DoD was able to justify the additional funding. Prior to FY 2003, the Army received \$1.4 billion for additional spare parts in anticipation of demand. The Army received the initial funding increase for FY 2003 in January, 2003. The requirement continued to increase as operations continued and \$4.0 billion in additional working capital funds and \$762 million in additional appropriations were funded by the end of FY 2003. At no time was the Army out of money and their requests for increases were expeditiously considered.

RECOMMENDATION 4: The GAO recommended that the Secretary of Defense direct the Secretary of the Navy to improve the accuracy of the Marine Corps' wartime supply requirements forecasting process by completing the reconciliation of the Marine Corps' forecasted requirements with actual OIF consumption data to validate the number as well as types of items needed and making necessary adjustments to their requirements. (Page 53/Draft Report)

DoD RESPONSE: Concur with intent. The Marine Corps has already taken action to improve the accuracy of its wartime supply requirements forecasting process by initiating a study and analysis that will reconcile actual OIF consumption against War Reserve material forecasted requirements. Part of the analysis will review the 1003V Withdrawal Plan requirements and compare to actual OIF consumption data.

RECOMMENDATION 5: The GAO recommended that the Secretary of Defense direct the Secretary of the Army and the Director of the Defense Logistics Agency to:

- minimize future acquisition delays by assessing the industrial base capacity to meet updated forecasted demands for critical items within the time frames required by operational plans, and
- provide visibility to Congress and other decision makers about how the department plans to acquire critical items to meet demands that emerge during contingencies.

(Page 53/Draft Report)

DoD RESPONSE: Concur with intent. The Army and DLA already have taken actions to minimize future acquisition delays by assessing the industrial base capacity and annual reports are provided to Congress.

Specific actions taken by the Army and DLA are as follows:

The Army issued Army Regulation 700-90 policy, dated December 2004, on the Army's Industrial Base Process which requires that the Army publish hardware priorities, war reserve stocks, and industrial preparedness measures that support war reserve and replenishment objectives, and the Army's Critical Items List. Also, it requires that Program Managers assess the industrial base ability to support life cycle requirements, develop Industrial Preparedness Planning Lists for those end items that need monitoring or action to ensure sufficient capacity, and perform surge planning to enable acceleration of program production and maintenance. The Army is participating in the development of the Joint Chiefs of Staff Critical Item List which is designed to identify items with industrial base weaknesses. To acquire critical items and to meet demands that emerge during contingencies, the Army has improved its acquisition and fielding processes. The Army has implemented the Rapid Fielding Initiative (RFI) to ensure that Soldiers have the latest available equipment. Equipment fielding schedules are revised to support operational plans and procurement and fielding cycles being compressed. In coordination with field commanders, mission-essential items are identified for rapid fielding, laying the foundation for acquisition transformation. Additionally, Army is accelerating fielding of select future capabilities to the force. Army has also instituted a Rapid Equipping Force that works directly with operational commanders to find solutions to operational requirements.

DLA currently assesses industrial base capacity to meet updated forecasted demands within the time frames required by operational plans during the acquisition cycle for long-term contracts. Additive demand associated with wartime and/or contingency support is identified as a separate surge and sustainment delivery schedule in solicitations released to industry. The forecasted, time-phased quantities are based on Service estimates provided through the annual deliberate planning process and/or actual requirements compiled from requisition data from previous contingency operations (like Operations Enduring Freedom and Iraqi Freedom (OEF/OIF)). Vendor responses must include an assessment of their capability to meet both peacetime and wartime demand. When shortfalls in industrial capability are identified, DLA works with industry to develop cost-effective solutions to production constraints that will improve industry capacity and response times. In some cases, the agency uses special appropriated Warstopper funding to invest in industrial capability improvements to avoid more expensive inventory-based solutions that could include the purchase of war reserve material that may or may not actually be used during a conflict.

In January 2005, DoD logistics leaders approved DLA's approach to enhance its support for medical items. DLA's medical readiness team worked closely with military service counterparts to ensure total wartime requirements were clearly identified. The medical directorate then assessed industrial base capability to meet the wartime/contingency requirement to determine shortfalls in coverage. The shortfalls were reviewed with the military services and a joint risk

See comment 8.

See comment 9.

assessment is used to prioritize the Agency's gap reduction strategy. Investments in contracts with surge and sustainment coverage for medical items eliminate any acquisition delays and ensure delivery within the time frames required by the operational plans.

Information on the acquisition of critical go-to-war items is reported to Congress annually through the Industrial Capabilities Report to Congress. This report summarizes industrial capability assessments that were performed and highlight actions taken to resolve industrial capability shortfalls that could impact national defense. Additionally, information concerning acquisition of critical items is provided Congress through various forums including the budget process, hearings, and congressional inquiries.

RECOMMENDATION 6: The GAO recommended that the Secretary of Defense:

- revise current joint logistics doctrine to clearly establish responsibility and authority for synchronizing the distribution of supplies from the U.S. to deployed units during operations,
- develop and exercise, through a mix of computer simulations and field training, deployable supply receiving and distribution capabilities including trained personnel and related equipment for implementing improved supply management practices, such as radio frequency identification tags that provide in-transit visibility of supplies, to ensure they are sufficient and capable of meeting the requirements in operational plans, and
- establish common supply information systems that ensure the DoD and the Services can requisition supplies promptly and match incoming supplies with unit requisitions to facilitate expeditious and accurate distribution.

(Page 54/Draft Report)

DoD RESPONSE: Concur with intent. In September 2003, the Department of Defense appointed the Commander, U.S. Transportation Command (USTRANSCOM), as the Distribution Process Owner. In this capacity, USTRANSCOM is tasked with developing efficient and effective distribution solutions to enhance strategic support to worldwide customers. The DPO is the DoD's one entity to revolutionize this system, working with the services and combatant commanders in synchronizing the distribution of personnel and equipment from factory to foxhole.

Actions addressing the GAO recommendation are underway as identified below:

In an effort to synchronize distribution with clearly established responsibility and authority within the DoD, USTRANSCOM established an Integrated Process Team (IPT). This team analyzes End-to-End (E2E) distribution processes by supply class. The two principle organizations executing E2E analysis are the DLA and USTRANSCOM. The Deployment and Distribution IPT also partners with the Joint Forces Command (JFCOM) to integrate the deployment process architecture into the distribution process architecture. The basic task of synchronizing the chain from CONUS to an employed theater of operations is incorporated into an ongoing effort within the E2E IPT with key deliverables by September 2005 and May 2006.

See comment 10.

See comment 11.

To improve distribution capabilities available to the combatant commander, the USTRANSCOM in concert with USCENTCOM have jointly established a forward logistics capability that is testing a mix of supply chain operations in a real world contingency environment. The establishment of the Deployment and Distribution Center in CENTCOM provides the warfighter a cadre of logistics experts from USTRANSCOM, the Defense Logistics Agency and national partners to provide a range of distribution related services such as scheduling, tracking, tracing and arranging for redistribution within the theater and back to home station. The center is equipped with a suite of modern distribution systems to allow real time information flow between all parties in the supply chain. This deployable capability will be continued to be field tested and combined with lessons learned from training exercises and best of breed commercial practices to continually improve the distribution process.

The Department issued policy on July 30, 2004, from the Under Secretary of Acquisition, Technology and Logistics directing that the DoD Components "...immediately resources and implement the use of high data capacity active Radio Frequency Identification (RFID) in the DoD operational environment" specifically to enhance in-transit visibility of our supplies. This direction expanded the use of active RFID to all Services, DLA and USTRANSCOM shipping full container loads to all overseas locations. Since that time, the DoD Components have resourced this requirement and are moving to implement.

At the end of September 2005, USTRANSCOM will begin information technology (IT) transition analysis. Process-based products include: capability gaps; improvement recommendations; performance metrics; impact to policy; identification of IT/systems supporting process activities; and changes to as-is Joint Distribution Architecture (JDA), representing the to-be architecture. The Supply Chain Operations Reference (SCOR) Model is the baseline used to develop the JDA. USTRANSCOM will begin to vet distribution process improvements in January 2006 through the Joint Capabilities Integration and Development Systems (JCIDS) for approval by the Joint Requirements Oversight Council (JROC). Anticipated duration of the JCIDS coordination is 4 to 12 months.

A pilot analysis was completed in May 2004 and USTRANSCOM is currently conducting IT transition analysis. The IT analysis will be integrated into the holistic IT analysis for all supply classes and deployment, beginning in FY 2006. Non-IT process recommendations will begin the JCIDS coordination this month, combined with additional Joint Theater Logistics OIF Lessons Learned process change recommendations, led by JFCOM.

IT analysis, discussed above, will be used to automate distribution process improvements, where appropriate, and integrate IT systems for E2E synchronization and total asset visibility. IT integration analysis will be conducted, in collaboration with national partners, using three teams: functional capabilities-based analysis team, consisting of functional process experts from each Service and DLA; technical analysis team, consisting of IT integration experts; and, business case analysis team, consisting of financial-technical experts.

USTRANSCOM will conduct the IT analysis in two, 120-day periods, with a final IT Transition Plan expected by May 2006. The first period, October 2005 to January 2006, will be dedicated

Appendix XI
Comments from the Department of Defense

to analyzing IT solutions to close process capability gaps. Teams will select IT solutions and develop a holistic IT transition plan for deployment and distribution during the second period, February 2006 to May 2006. Once completed, the product will be an IT transition plan recommending the most effective systems integration solution to synchronize distribution, at best value to the government.

GAO's Comments

The following are GAO's comments on DOD's letter dated March 23, 2005.

1. The department cited action it is taking to improve modeling and data for determining war reserves that may meet our recommendation to update the war reserve models, once it is fully implemented. We agree that by developing a methodology that will capture and use OIF consumption data to update the model within the Army War Reserve Requirements Automated Process, DOD should improve the accuracy of the Army's war reserve requirement. However, the department provided no timeline for the implementation of this effort. Therefore we modified our recommendation to require that DOD specify when this action will be completed.
2. We agree that the department's decision to conduct annual updates of the Army War Reserve Requirements Process to compute new war reserve requirements to keep pace with Army, DOD and joint operational guidance should improve the accuracy of the requirements, as long as the updates are conducted as required.
3. DOD did not commit to any specific action to address our recommendation to disclose the risks associated with the percentage of war reserves being funded. After acknowledging a lack of adequate funding and the associated risk of such underfunding to the availability of war reserve items, DOD noted the Army was already reporting these risks to Congress in various forums. However, as noted in this report, budget documentation does not clearly state the risk of underfunding the war reserves; and we believe the other methods cited by DOD in its comments do not ensure consistent transparency to Congress of risks to military operations. We continue to believe our recommendation has merit and should be implemented. In addition, we have added a matter for Congressional consideration that suggests Congress may wish to require DOD to disclose the risks associated with not fully funding the Army war reserve.
4. The near and long-term actions DOD cited to improve modeling support for prewar planning could address our recommendation when completed. However, we remain concerned because their effectiveness will not be known until these initiatives are fully implemented years from now. After agreeing that the Army currently lacks a dynamic forecasting system, the department stated that for the near-term it has been implementing a new database to compute demand changes during

contingency operations that will work in conjunction with the current supply forecasting system, but did not state when the change would be completed. Moreover, according to DOD, the long-term solution to the Army's forecasting problem is fielding of a new supply management system, the Logistics Modernization Program. However, the full implementation of this initiative is tentatively scheduled for fiscal year 2007, but could be affected by events. Furthermore, as indicated in this report, there are also issues with the reliability of the data used in the Logistics Modernization Program that may affect its ability to properly forecast demands. Therefore, we continue to believe our recommendation has merit until these actions are fully implemented. We have also modified our recommendation to require that DOD specify when these actions will be completed.

5. The department did not commit to any specific actions to ensure item managers are provided operational information in a timely manner so they can improve the accuracy of modeled wartime forecasts. In the report, we noted the importance of item managers in setting requirements for supplies during OIF and cited concerns about failure to provide them operational information promptly. Furthermore, DOD noted that Army weapon system (item) managers made stockage decisions for OIF largely based on historical data that proved to be understated because operational tempo was as much as 12 times higher than normal peacetime rates. However, DOD's response did not mention how it would better equip these managers to affect wartime forecasts if necessary. We believe that until and even after the proposed improvements to modeling are successfully implemented, item managers will remain a vital part of forecasting operational supply requirements. Therefore, we continue to believe our recommendation has merit.
6. DOD's response to our recommendation to reduce the time delay in the Army's process for granting increased obligation authority to the Army Materiel Command noted the validation process is necessary and must be expeditious, but did not cite any specific actions it would be taking to achieve that end. We agree with the department that an appropriate validation process is critical to justifying additional obligation authority or a cash infusion, particularly in light of the size of the increases over budgeted amounts. Our recommendation did not ask the Army to sacrifice due diligence in this process. Rather, our concern is, as noted in this report, AMC did not receive sufficient obligation authority to support meet its requirements until four months after major combat

operations ended. As shown in this report, the cause for this delay was the time consuming process used by the Army to validate AMC's requests, not the Office of Secretary of Defense's process for delivering the funds. As we reported, without an expeditious funding approval process, item managers had difficulty buying supplies in a timely manner in the right quantity to meet war fighter needs, resulting in decreased operational capabilities and increased risk. Therefore, we continue to believe our recommendation has merit. We have also modified our recommendation to require that DOD specify when this action will be completed.

7. We agree with the department's actions in response to our recommendation that the Navy improve the accuracy of the Marine Corps' wartime supply forecasting process. The planned actions should, when completed, improve the accuracy of that process. However, DOD provided no clear schedule for the implementation of this initiative. Therefore, we have also modified our recommendation to require that DOD specify when this action will be completed.
8. DOD's response to our recommendation cites Army and DLA actions to minimize future acquisition delays by assessing the industrial base capacity to meet updated forecasted demands for critical items, that when fully implemented, could achieve the intent of the recommendation. The Army Regulation 700-90, dated December 2004 established a framework for systematically assessing the industrial base's ability to support requirements. As noted in our report, the Joint Chiefs of Staff Critical Few List identifies rapidly emerging or critical items at the service and geographic command level and the Rapid Fielding Initiative accelerates acquisition of high priority items for troops. In combination, these and other initiatives may provide a means to reduce acquisition delays. In addition, DLA's review of industry and continued use of War Stopper funding to invest in industrial capacity, should help DOD avoid some future acquisition delays. Therefore, we have also modified our recommendation to require that DOD specify when these actions will be completed.
9. DOD did not commit to any action to provide consistent visibility to Congress and other decision makers about how the department plans to acquire critical items to meet emerging demands. It stated that it already addresses this recommendation annually through the Industrial Capabilities Report Congress and other forums. While we agree that DOD provided visibility about some items, such as body armor in the

February 2004 Industrial Capabilities Report, neither the report or the other forums addressed the issues we identified about the acquisition of up-armored HMMWVs and kits. Providing clear information in consistent manner for critical items with rapidly emerging demands could have clarified the department's acquisition challenges and equipped Congress to allocate funds or take other actions to increase the speed of acquisition.

10. In response to our recommendation to clarify responsibility and authority for synchronizing distribution of supplies, DOD stated it had appointed U.S. Transportation Command as the responsible organization for distribution in September 2003. However, neither the command nor the department have committed to revising joint doctrine to clarify how the command will interact with the services and geographic commands to accomplish this. As mentioned in our report, current doctrine prescribes a disjointed distribution management structure that does not support the timely delivery of supplies to the war fighter. While it is taking steps to analyze distribution processes, we believe DOD must also commit to making institutional changes through joint doctrine to ensure the geographic combatant commander benefits from a seamless distribution process. Therefore, we continue to believe our recommendation has merit. We have also modified our recommendation to require that DOD specify when this action will be completed.
11. DOD cited the establishment of the Deployment and Distribution Center in CENTCOM as its means of responding to our recommendation to develop and exercise deployable supply receiving and distribution capabilities. While this center may test a forward deployable logistics capability based on a cadre of logistics experts with enhanced communications capabilities, we do not see the department's commitment to ensuring through simulation and field training that there are sufficient number trained personnel and related equipment to meet the requirements of operational plans. As noted in our report, the lack of sufficient logistics resources in theater before and during the arrival of combat forces hindered DOD's efforts to move supplies promptly from ports to units. We believe having a pre-established deployable capability that includes sufficient and trained personnel, at all levels of command; communications systems; and necessary equipment will speed the establishment of a theater distribution system. Therefore, we believe additional actions are necessary to fully address our recommendation. We have also modified

our recommendation to require that DOD specify when these actions will be completed.

12. DOD stated that it is taking a number of actions to develop a holistic information technology plan to improve distribution. According to DOD, this plan, which is expected to be completed in May 2006, will recommend systems integration solutions to synchronize end-to-end distribution. We remain concerned that until this plan is completed and its recommendations fully implemented, DOD and the services will not be able to achieve their goal of distributing the right supplies to the right places when war fighters need them. Therefore we have also modified our recommendation to require DOD to specify when the plan's recommendations will be implemented.

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